2000 Stock Assessment and Fishery Evaluation for Atlantic Highly Migratory Species

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Dealer Permits:

Tuna dealer permits are issued out of the Northeast Regional Office of NMFS (978-281-9370), shark and swordfish dealer permits are issued out of the NMFS Southeast Regional Office (727-570-5326).

Atlantic Tuna Permits:

Questions regarding the Atlantic tunas permit process should be directed to AppNet Customer Service at (888) 872-8862, Monday through Friday, from 8 a.m. to 5 p.m. Eastern Time. Fishermen may also listen to or view updates to the regulations via the toll-free automated telephone system or the website (www.nmfspermits.com).

Atlantic Shark and Swordfish Permits:

Questions regarding renewals or transfers of shark and swordfish limited access permits should be directed to the NMFS Southeast Regional Office (727-570-5326).

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EXECUTIVE SUMMARY

The Stock Assessment and Fishery Evaluation Report (SAFE Report) provides a summary of the best available scientific information on the condition of stocks, marine ecosystems, and fisheries being managed under federal regulation. Consistent with the guidelines for National Standard 2 of the Magnuson-Stevens Act, the SAFE Report is prepared annually and used as a reference in the evaluation and refinement of fisheries management practices. The report updates the data necessary to determine appropriate annual harvest levels, documents significant trends in the resource, marine ecosystems, and fishery over time, and identifies associated bycatch and safety issues. Through a comprehensive annual update of key biological, economic, and social indicators, the National Marine Fisheries Service (NMFS) can ensure use of the best available scientific data in its decision making process.

The 2000 SAFE Report for Atlantic Highly Migratory Species (HMS) closely follows the April 1999 publication of the *Final Fishery Management Plan for Atlantic Tunas, Swordfish, Sharks* (HMS FMP) and *Amendment 1 to the Atlantic Billfish Fishery Management Plan* (Billfish Amendment). The SAFE Report includes the latest stock assessment data, recommendations, and resolutions from The International Commission for the Conservation of Atlantic Tunas (ICCAT) and their Standing Committee on Research and Statistics (SCRS). The report is divided into the following sections: Stock Assessment Update; Essential Fish Habitat; Fishery Data Update; Community Data Update; Fish Processing Industry and Trade; Bycatch; Limited Access and Permitting; Issues for Consideration; and Outlook.

Stock Assessment Update

The SCRS conducted three stock assessments in 1999: North Atlantic swordfish, South Atlantic swordfish, and bigeye tuna. Although results for both of the swordfish assessments were more optimistic than earlier assessments, the North Atlantic stock remains overfished. According to the 1999 assessment, Atlantic bigeye tuna are also overfished and the catch of undersized bigeye continues to be a problem. The SCRS is planning assessments of west Atlantic bluefin tuna, Atlantic yellowfin tuna, North Atlantic and South Atlantic albacore tuna, Atlantic blue marlin, and Atlantic white marlin in 2000 and a west Atlantic sailfish assessment in 2001.

Essential Fish Habitat

Thirty-three species of sharks, predominantly small, deep-water species not targeted in HMS fisheries, were added to the HMS management unit as part of consolidated regulations published in May 1999. NMFS is currently using Geographic Information Systems (GIS) to analyze all available data for these species. Results and complete Essential Fish Habitat (EFH) descriptions are expected by spring 2000 and will be issued in an addendum to the 2000 SAFE Report.

Fishery Data Update

There are a several sources of new information concerning HMS fisheries. These include updated catch and landings data, logbook and observer data, new economic and market analyses, and recently conducted social surveys. In this document, data are analyzed by gear type to more easily assess the implications for the fishery. Some of the more important developments from 1999 are: ICCAT's adoption of a 10 year rebuilding program for North Atlantic swordfish and its implications for pelagic longline fishermen; the proposal of time/area closures to reduce bycatch in the pelagic longline fishery; the removal of the cap on the Purse Seine category bluefin tuna allocation; revised statistics on the level of U.S. recreational and commercial landings of yellowfin tuna since 1981; ICCAT's resolution to improve recreational fishing statistics, including the future inclusion of a discussion of recreational fisheries in each member country's National Report; and the updated estimates of shark catches by U.S. fishermen from the 1999 Shark Evaluation Annual Report.

Community Data

Compliance with National Standard 8 is contingent upon the availability of community studies and profiles. As HMS by definition are highly migratory resources, fishermen often tend to shift locations in attempt to follow the fish. The inclusion of typical community profiles in HMS management decisions is somewhat difficult and continued social and community studies to identify the participants in these fisheries are of great importance. Recent assessments have included a profile of commercial fishermen and a state-by-state survey of recreational fishermen.

Fish Processing Industry and Trade

Domestic and international consumer preference continues to play a large role in HMS markets. Bluefin tuna trade remains strictly monitored through use of the Bluefin Statistical Document program. Data indicate that roughly 59 percent of bluefin tuna landed in the United States in 1998 were exported. Sharks and shark products continue to be an important export, although the nature of reporting is much less detailed than that used for bluefin tuna. Swordfish are an important import into the United States, as indicated by data collected through the Swordfish Import Monitoring Program. The use of trade data is an important tool in the monitoring and management of HMS and an effective supplement to existing information sources.

Bycatch

Bycatch of finfish and sea turtles and incidental catches of marine mammals and sea birds continue to be areas of concern in HMS management. There is the also the issue of HMS as bycatch in the squid mid-water trawl and menhaden purse seine fisheries. Through actions including educational workshops, studies on the effectiveness of gear modifications, proposed time/closures, and continued life history research, NMFS is addressing the recommendations proposed in the National Bycatch Plan and work towards reducing bycatch mortality in HMS fisheries.

Limited Access and Permitting

NMFS continues to explore effective and equitable means to reduce overcapitalization problems. As of December 30, 1999, there were 976 total permit holders in the limited access commercial shark and swordfish fisheries. The results and relative success of limited access will become more apparent as the year progresses. However, if the harvesting capacity in these fisheries continues to greatly exceed the available number of fish, NMFS may be forced to examine other alternatives.

NMFS has made significant improvements to its Atlantic tunas permitting system, including a website where constituents can purchase initial and renewal permits for Atlantic tunas, update permit information, and report recreational landings of bluefin tuna (www.nmfspermits.com). Increasing the level of automation in the permitting process as well as the methods of renewal (i.e., phone, fax, Internet) is expected to improve constituent satisfaction. NMFS hopes to build upon this success and consider automating other HMS permitting processes in the future.

Issues for Consideration

Since the release of the HMS FMP, NMFS has addressed some constituent concerns through the framework adjustment process. These include the removal of the purse seine cap (64 FR 58793, November 1, 1999) and the proposed time/area closures for pelagic longline gear (64 FR 69982, December 15, 1999). Issues for consideration over the next calendar year include the publication of a "Miscellaneous Rule" that would amend the regulations so they conform more closely to the provisions of the HMS FMP and the Billfish Amendment, the 1999 ICCAT rule, and the final rule for the time/area closures. In addition, the development of a rebuilding plan for North Atlantic albacore tuna may also be considered.

Outlook

The year 1999 was an eventful one for HMS. Management measures from the HMS FMP and the Billfish Amendment are still in the process of being implemented and evaluated. New SCRS information, new ICCAT recommendations, and other recently released studies need to be incorporated, consistent with National Standard 2. Improvements in data coordination and management within NMFS and with other agencies should contribute to increasingly effective monitoring and management.

In 2000, NMFS plans to continue implementing and evaluating the FMP measures in an attempt to address overfishing and overcapitalization problems that affect many highly migratory species. The February 2000 HMS Advisory Panel meeting provides an excellent opportunity to identify and discuss those issues raised in the SAFE report which require further action. Through continuous public and constituent interaction, increased monitoring, ongoing life history work, and additional socio-economic assessment, NMFS strives to continue building sustainable fisheries for all Atlantic highly migratory species.

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1. INTRODUCTION

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) establishes a long-range management process to manage sustainably the nation's fisheries beginning with the creation of a Fishery Management Plan (FMP). A component of the *Final Fishery Management Plan for Atlantic Tunas, Swordfish, Sharks* (HMS FMP) and *Amendment I to the Atlantic Billfish Fishery Management Plan* (Billfish Amendment) is the production of an annual Stock Assessment and Fishery Evaluation (SAFE) report. The SAFE report provides a summary of the best available scientific information on the condition of stocks, marine ecosystems, and fisheries being managed under federal regulation. Consistent with the guidelines for National Standard 2 (NS 2) of the Magnuson-Stevens Act, the SAFE report is prepared annually and used as a reference in the evaluation and refinement of fisheries management practices. The report updates the data necessary to determine appropriate annual harvest levels, documents significant trends in the resource, marine ecosystems, and fishery over time, and identifies associated bycatch and safety issues. Through a comprehensive annual update of key biological, economic, and social indicators, NMFS can ensure use of the best available scientific data in its decision making process.

The 2000 SAFE report for Atlantic Highly Migratory Species closely follows the April 1999 publication of the HMS FMP and Billfish Amendment. It is a vehicle to introduce information made available after the final HMS FMP, identify additional management issues that may need to be addressed, and begin preliminary assessment and evaluation of the fishery regulations. The SAFE report includes the latest stock assessment data, recommendations, and resolutions from The International Commission for the Conservation of Atlantic Tunas (ICCAT) and their Standing Committee on Research and Statistics (SCRS). In adherence with NS 2 guidelines, the report presents a comprehensive summary of the most recent Atlantic HMS fisheries-related data from a variety of sources across a wide range of disciplines. In addition, the current information is contrasted with previous years' data to highlight important trends and concerns for future management.

The report is divided into the following sections: Stock Assessment Update; Essential Fish Habitat; Fishery Data Update; Community Data Update; Fish Processing Industry and Trade; Bycatch; Limited Access and Permitting; Issues for Consideration; and Outlook. As discussed further in the report, the data and information necessary for effective HMS management come in various forms. The structure of the SAFE report is designed to provide a cohesive view of new information and present it in a format that is easily accessible to managers, Advisory Panel members, and the public.

2. STOCK ASSESSMENT UPDATES

Stock assessments are periodically conducted to determine status relative to both international and domestic management criteria. Assessments for tunas, swordfish, and billfishes are conducted by The International Commission for the Conservation of Atlantic Tunas (ICCAT) and their Standing Committee on Research and Statistics (SCRS). Assessments for Atlantic sharks are conducted by NMFS. North and South Atlantic swordfish and Atlantic bigeye tuna assessments, as well as an attempt to assess West Atlantic skipjack tuna were conducted in 1999. Results are detailed in Sections 2.1, 2.3.1, and 2.3.4 respectively. For the other HMS stocks, a brief review of the most recent assessment information and any new species-specific (primarily biological) studies with management implications are discussed. As established in the HMS FMP, a stock is considered overfished when the biomass level (B) is less than the minimum stock size threshold (MSST) and overfishing is occurring when the fishing mortality rate (F) exceeds the maximum fishing mortality threshold (MFMT). A summary of status (using HMS criteria) is provided in Table 2.1.

Table 2.1 HMS Status Summary Table*

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
Atlantic Swordfish: North Atlantic Stock	B_{99}/B_{MSY} = 0.65 (0.51 -1.05)	$0.8B_{MSY}$	F_{98}/F_{MSY} = 1.34 (0.84-2.05)	F_{MSY}	Overfished; overfishing continues to occur
Atlantic Swordfish: South Atlantic Stock**	B_{99}/B_{MSY} = 1.10 (0.84-1.40)	$0.8B_{MSY}$	F_{98}/F_{MSY} = 0.81 (0.47-2.54)	F_{MSY}	Fully fished; Overfishing probably continues to occur
West Atlantic Bluefin Tuna	SSB_{97}/SSB_{MSY} (two-line) = 0.48 SSB_{97}/SSB_{MSY} (Beverton-Holt) = 0.071 SSB_{97}/SSB_{75} = 0.14-0.17	$0.86B_{MSY}$	F_{97}/F_{MSY} (two-line)= 1.73 F_{97}/F_{MSY} (Beverton-Holt) = 4.10	F_{MSY}	Overfished; overfishing continues to occur

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
Atlantic Bigeye Tuna* **	SSB_{98}/SSB_{MSY} = 0.57-0.63	*$0.6B_{MSY}$ (age 2+)*	F_{98}/F_{MSY} = 1.50-1.82	F_{MSY}	Overfished; overfishing is occurring
Atlantic Yellowfin Tuna** **	unknown	*$0.5B_{MSY}$ (age 2+)*	F_{97}/F_{MSY} = 0.92-1.35	F_{MSY}	Stock not overfished; overfishing may be occurring
North Atlantic Albacore Tuna*** **	B_{97}/B_{MSY} = 0.47 (0.34-0.63) B_{90-94}/B_{75-80} = 0.72	*$0.7B_{MSY}$*	F_{97}/F_{MSY} = 1.39 (uncertain) F_{97}/F_{MAX} = 0.91 $F_{97}/F_{0.1}$ = 1.60	F_{MSY}	Overfished; overfishing is occurring; SCRS notes that stock is at, or above, full exploitation
West Atlantic Skipjack Tuna	unknown	unknown	unknown	F_{MSY}	unknown
Atlantic Blue Marlin	B_{96}/B_{MSY} = 0.24	*$0.9B_{MSY}$*	F_{95}/F_{MSY} = 2.87 (1.45-3.41)	F_{MSY}	Overfished; overfishing is occurring
Atlantic White Marlin	B_{96}/B_{MSY} = 0.23	*$0.85B_{MSY}$*	F_{95}/F_{MSY} = 1.96 (1.33-2.91)	F_{MSY}	Overfished; overfishing is occurring
Atlantic Sailfish	B_{92-96}/B_{MSY} = 0.62	*$0.75B_{MSY}$*	F_{91-95}/F_{MSY} = 1.40	F_{MSY}	Overfished; overfishing is occurring
Blacktip Shark	N_{98}/N_{MSY}=0.50 (baseline) N_{98}/N_{MSY}=0.48 (alternative)	*$0.9B_{MSY}$*	F_{97}/F_{MSY} = 3.52 (baseline) F_{97}/F_{MSY} = 3.74 (alternative)	F_{MSY}	Overfished; overfishing is occurring
Sandbar Shark	N_{98}/N_{MSY}=0.58 (baseline) N_{98}/N_{MSY}=0.70 (alternative)	*$0.9B_{MSY}$*	F_{97}/F_{MSY} = 2.70 (baseline) F_{97}/F_{MSY} = 1.62 (alternative)	F_{MSY}	Overfished; overfishing is occurring

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
Large Coastal Sharks (all species)	N_{98}/N_{MSY}=0.30 (baseline) N_{98}/N_{MSY}=0.36 (alternative)	$0.9B_{MSY}$	F_{97}/F_{MSY} = 6.34 (baseline) F_{97}/F_{MSY} = 6.03 (alternative)	F_{MSY}	Overfished; overfishing is occurring
Small Coastal Sharks	B_{91}/B_{MSY} = 1.12	$0.9B_{MSY}$	$F_{86\text{-}91}/F_{MSY}$ = 0.89	F_{MSY}	Stock not overfished; overfishing is not occurring
Pelagic Sharks	unknown	unknown	unknown	unknown	unknown

*Current Relative Biomass Levels and Current Fishing Mortality Rates are established by the SCRS for tunas, swordfish, and billfish, and by NMFS for sharks. Minimum Stock Size Threshold and Maximum Fishing Mortality Threshold are levels set by NMFS in accordance with the provisions of the Magnuson-Stevens Act. These distinctions apply wherever these terms are found throughout the document.
**South Atlantic swordfish are not found in the U.S. EEZ and, therefore, not managed under the Magnuson-Stevens Act. The classification of the stock as fully fished is based on the definitions established in the HMS FMP and is for descriptive purposes only.
***B/B_{MSY} and F/F_{MSY} ranges for bigeye tuna are ranges of estimates from different model formulations rather than confidence intervals around an estimate.
****F/F_{MSY} ranges for yellowfin tuna are ranges of estimates from different model formulations rather than confidence intervals around an estimate.
*****Due to the uncertainty of F/F_{MSY} for North Atlantic albacore tuna, three equations are presented for Current Fishing Mortality Rate.

2.1 Stock Assessment Update: NORTH AND SOUTH ATLANTIC SWORDFISH

The SCRS completed a stock assessment of North and South Atlantic swordfish in October 1999. The assessment utilized landings and discard data as well as fishing effort information submitted by ICCAT member and non-member nations. These data provide minimum estimates due to unreported landings from vessels flying flags of convenience and other unreported sources of mortality from both member and non-member nations (SCRS, 1999a). This section provides a summary interpretation of the stock assessment results.

2.1.1 Life History/Species Biology Information

North and South Atlantic swordfish are currently managed as two separate stocks of fish. The stocks are divided by a line designated for management purposes at 5 degrees north latitude. In 1999, two new genetic studies were presented to the SCRS concerning swordfish. Both studies found significant differences between Northwest Atlantic, South Atlantic, Mediterranean, and Indo-Pacific swordfish. It is important to note that management measures are necessary in both the North and South Atlantic in light of the uncertainty associated with the stock structure assumption.

Considerable effort was expended to incorporate new sex-specific catch-at-age data into the assessments. Results were corroborative of other modeling approaches and provided further support for management advice.

2.1.2 Most Recent Stock Assessment Data

Table 2.1.1 **Summary Table for North and South Atlantic Swordfish**. Source: SCRS, 1999, unless otherwise indicated.

Stock (2 stocks; divided at 5°N. Lat.)	**North Atlantic**	**South Atlantic**
Age/size at Maturity	Females: 50% are mature at 179 cm lower jaw fork length (LJFL) (5 years) Males: 50% are mature at 129 cm LJFL (Arocha, 1997)	
Spawning Sites	Warm tropical and sub-tropical waters (throughout the year)	
Current Relative Biomass Level (B_{1999}/B_{MSY}) *Minimum Stock Size Threshold*	0.65 (0.51-1.05) $0.8B_{MSY}$	1.10 (0.84-1.40) $0.8B_{MSY}$
Current Fishing Mortality Rate F_{1998}/F_{MSY} *Maximum Fishing Mortality Threshold*	1.34 (0.84-2.05) F_{MSY}	0.81 (0.47-2.54) F_{MSY}
Outlook	Overfished; overfishing continues to occur	Fully fished*; Overfishing maybe occurring
Management Measures in Place	Reduced stock-wide total allowable catch (TAC) Include dead discards in TAC Time/area closures in U.S.	N/A

*South Atlantic swordfish are not found in the U.S. EEZ and, therefore, not managed under the Magnuson-Stevens Act. The classification of the stock as fully fished is based on the definitions established in the HMS FMP and is for descriptive purposes only.

Stock Assessment Methods

SCRS used a surplus production model that is commonly applied to HMS assessments. It is a dynamic model (non-equilibrium) that incorporates the catch per unit effort (CPUE) biomass index and estimated dead discards. The model also accounts for two different types of longline fisheries; those that target swordfish and those that target other species. The advantage of this model is that it estimates parameters based on simple abundance statistics. However, this model uses few parameters and does not employ age- or size-specific information available for the swordfish fishery.

The surplus production model was fit to the data using two different fitting approaches: 1) using maximum likelihood fitting of predicted versus observed data (ASPIC), and 2) a Bayesian framework. The Bayesian framework was only used in the North Atlantic stock assessment. The

Bayesian approach incorporates the prior possibility of unobserved parameters such as the intrinsic rate of increase given the probability of the observed data. Both fitting approaches provided similar management advice.

The third model used in the North Atlantic swordfish stock assessment was the virtual population analysis (VPA). This model is a retrospective analysis of a time series of age-specific data in which abundance estimates are updated each year. The age data were estimated from catch at size data and growth equations for males and females. The North Atlantic assessment incorporated both a sex-specific and non sex-specific model. Results for the final years in the time series (i.e., the recent past) can vary widely as data are updated annually. In these models, historic data are more stable and generate more reliable results.

SCRS also conducted yield per recruit and spawners per recruit models for female data alone and for the combined sexes. Spawning biomass per recruit information was based only on the female spawning stock under the hypothesis that males were not limiting to swordfish reproductive success. These can be age-structured models and make optimal use of the available swordfish data.

Catch Rates and Stock Assessment Implications

Some fleets are moving away from targeting swordfish in favor of a multi-species approach (Spain) while other nations are changing target species to swordfish (Brazil). These changes may affect the estimated CPUE time series used by SCRS in the stock assessment models for North and South Atlantic swordfish. This is a particular problem in non-swordfish targeting fisheries where zero catch records of swordfish are not related to abundance, but rather a lack of swordfish availability to the fishing gear. Total catch levels reported to ICCAT reflected a sharp drop-off in 1998 versus previous years" data. 1998 catch levels were estimated at 12,175 metric tons (mt) in the North Atlantic, 13,468 mt in the South Atlantic, and 5,458 mt in the Mediterranean. 1997 reported catches were 12,931 mt, 18,494 mt, and 14,669 mt respectively.

All of the following stock assessment results are based on total mortality estimates. To maintain accuracy, all sources of mortality (i.e., dead discards and landings) should be included when reporting swordfish catch. A discussion of the plan and the implications for U.S. fisherman can be found in Section 4.

North Atlantic Swordfish Stock Assessment Results

Most of the model runs for North Atlantic swordfish estimate that the current biomass is below the MSY level, and that the fishing mortality rate is above F_{MSY}. Projections for stock recovery were done with a wide variety of models and several options for rebuilding were investigated.

The surplus production model, ASPIC, indicates that rebuilding (with 50 percent probability) of North Atlantic swordfish to B_{MSY} can occur in 10 years (by 2009) if there is a

decrease in catch to 10,000 MT (TAC of 9,090 MT plus expected overages).

The Bayesian results indicate that rebuilding (with 48 percent probability) can occur in 10 years at status quo catch levels. A number of sensitivity analyses were conducted using alternative production model formulations and inputs. Two of seven sets of runs indicated a greater than 50 percent chance of rebuilding to B_{MSY} within 10 years at the current (1998) catch levels while six When input parameters are slightly modified, existing catch levels produce a 31 percent chance of rebuilding in 10 years. In the second and third of the Bayesian models, 6,000 mt or below or 10,000 mt (depending on input parameters) are required in order to have a 50 percent chance of rebuilding within 10 years.

The VPA indicates that catch would have to be less than 9,000 mt to reach the target spawning stock level within 10 years.

Summary of North Atlantic Results

Total swordfish biomass corresponding to MSY levels is not likely to be achieved with status quo catch levels. All models indicate that reductions in catch would allow for the population to have a greater than 50 percent chance of recovery in 5, 10, or 15 years.

Summary of South Atlantic Results

The SCRS noted quite a bit of uncertainty in the South Atlantic swordfish models. Continued harvest at current quota levels in the South Atlantic will result in a continued gradual reduction in biomass; the expected levels of decline and the associated timing vary between models. Fishing mortality is likely to continue to increase gradually and reach F_{MSY} in 2006. Reducing the catch will assist in supporting a healthy South Atlantic stock. The confidence intervals obtained in the projections for the rebuilding cases spanned a broad range and cast some doubt on the accuracy of the results. In addition, there is a good deal of uncertainty surrounding the projection results themselves due to ambiguity in the CPUE trend for the non-target fisheries.

2.1.3 Minimum Stock Size Threshold

In the HMS FMP, NMFS determined the MSST for North and South Atlantic swordfish to be $0.8B_{MSY}$, based on estimates of natural mortality. The North Atlantic stock is **below** the minimum stock size threshold ($0.65B_{MSY}$). This stock is overfished and NMFS seeks to rebuild it, with international cooperation, within ten years.

The South Atlantic stock is estimated to be **above** the minimum stock size threshold ($1.10B_{MSY}$) but the range is very broad ($.84\text{-}1.40B_{MSY}$). The South Atlantic stock assessment has considerable uncertainty associated with it due to a limited data set, lack of age and growth data, and a lack of reporting by some nations.

2.1.4 Maximum Fishing Mortality Threshold

In the HMS FMP, NMFS also set the maximum level of fishing mortality on these stocks. Overfishing is occurring if F exceeds F_{MSY}. The FMP also notes, however, that ICCAT generally adopts constant quota recommendations, and that ICCAT treats F_{MSY} as a target, not a limit. NMFS set a target of 0.75 F_{MSY} for healthy stocks to reduce the probability that the maximum fishing mortality threshold would be exceeded. Mortality on the North Atlantic stock **exceeds** the maximum fishing mortality threshold and the stock is being overfished. In 1998, the fishing mortality rate was too high to promote rebuilding (F_{1998}/F_{MSY} = 1.34). Mortality on the South Atlantic swordfish stock is **below** the threshold , however, there is more uncertainty associated with the models for this stock and the range varies widely (0.47-2.54). For these reasons, NMFS encourages the use of the precautionary approach when managing the South Atlantic stock. Data collection is difficult due to the number of countries fishing on this stock and the potential mixing of the North and South Atlantic stocks.

2.2 Stock Assessment Update: WEST ATLANTIC BLUEFIN TUNA

The SCRS did not conduct a new stock assessment for Atlantic (west or east) bluefin tuna in 1999. The latest stock assessment was conducted in 1998, and the next assessment is scheduled for September 2000. The HMS FMP includes a summary of the 1998 Atlantic bluefin tuna stock assessment (Section 2.2.1).

2.2.1 Life History/Species Biology Information

There are several research projects underway regarding the life history of west Atlantic bluefin tuna. Topics of investigation include stock structure, migration patterns, and reproduction. These studies are described in the Comprehensive Research and Monitoring Plan for Atlantic Highly Migratory Species (Appendix I). Additional information on the life history of west Atlantic bluefin tuna can be found in the HMS FMP (Sections 2.2.1 and 6.3.1.3).

2.2.2 Most Recent Stock Assessment Data

ICCAT currently manages Atlantic bluefin tuna based on a two-stock hypothesis. The two management units are separated at 45° W above 10° N and at 25° W below the equator, with an eastward shift in the boundary between those parallels. U.S. vessels fish on west Atlantic bluefin tuna.

The total reported catch of Atlantic bluefin tuna (both east and west) reached a historical high in 1996 at 54,723 mt. Total catch in 1998 has been estimated at 44,700 mt (1998 reported catch is only an estimate as catch reports were missing from some nations) (SCRS, 1999b). There has been a dramatic increase in total Atlantic bluefin tuna catches since 1994 due to increased catches in the east Atlantic and Mediterranean. The west Atlantic catch has been limited between 2,000 and 2,700 mt through a quota since 1982. In 1998 ICCAT adopted measures designed to rebuild west Atlantic bluefin tuna to F_{MSY} within 20 years.

Information on the stock status of west Atlantic bluefin tuna as of 1998 is presented in Table 2.2.1. East Atlantic bluefin spawn in the Mediterranean Sea, and are thought to spawn at a younger age (age 5) than west Atlantic bluefin. Bluefin catch in the east was approximately 42,000 mt in 1998 with the current sustainable yield estimated at 25,000 mt. West Atlantic 1998 catch was 2,643 mt (including discards) and sustainable yield (1997) was estimated between 2,000 and 2,500 mt. The SCRS projections indicate that current catch levels of bluefin tuna in the east Atlantic and Mediterranean are not sustainable, and that the condition of the east Atlantic stock and fishery may adversely affect recovery of the bluefin tuna stock in the west Atlantic.

Table 2.2.1 Summary Table for West Atlantic Bluefin Tuna

Age/size at Maturity	Age 8/~ 200 cm fork length
Spawning Sites	Gulf of Mexico and Florida Straits
Current Relative Biomass Level *Minimum Stock Size Threshold*	SSB_{97}/SSB_{MSY} (two-line) = 0.48 SSB_{97}/SSB_{MSY} (Beverton-Holt) = 0.071 SSB_{97}/SSB_{75} = 0.14 - 0.17 $0.86B_{MSY}$
Current Relative Fishing Mortality Rate F_{1997}/F_{MSY} *Maximum Fishing Mortality Threshold*	F_{97}/F_{MSY} (two-line)= 1.73 F_{97}/F_{MSY} (Beverton-Holt) = 4.10 F_{MSY}
Outlook	Overfished; overfishing continues to occur
Management Measures in Place	20-Year ICCAT Rebuilding Program; TAC including dead discards; minimum sizes.

2.3 Stock Assessment Update: BAYS TUNAS

2.3.1 ATLANTIC BIGEYE TUNA

The SCRS completed a stock assessment of Atlantic bigeye tuna in October 1999. The assessment utilized catch and effort information submitted by ICCAT member and non-member nations. This section provides a summary interpretation of the stock assessment results.

The 1999 SCRS report/stock assessment for bigeye tuna indicates (as have previous SCRS reports) that the catch of undersized fish remains a major problem in the Atlantic bigeye tuna fishery. The share of bigeye tuna less than the ICCAT minimum size (3.2 kg) is approximately 55 percent, by number, of all bigeye tuna harvested. This number has stabilized since with the time/area closure for purse seining in the eastern tropical Atlantic area (detailed in Section 4.2.3), but still remains a concern (SCRS 1999b).

In 1997, SCRS recommended a reduction of overall catch of bigeye tuna to at least the 1992 level (approximately 85,000 mt in the 1997 estimate, but revised to 97,000 mt in 1999). The 1998 catch was 95,000 mt, slightly less than 1992 levels, but still higher than the sustainable catch level. The results of the latest stock assessment indicate an MSY between 79,000 and 94,000 mt. One important component of the 1999 bigeye tuna assessment was the incorporation of revised data from previous years. This resulted in the addition of some 20,000 mt of previously unreported catch. SCRS recommended a reduction of catch to approximately 80,000 mt to reduce the probability of further decline of the stock, although an additional reduction of catch would be required to rebuild the stock to MSY levels. The SCRS was unable to provide recovery projections in 1999 due to lack of data.

2.3.1.1 Life History/Species Biology Information

Compared to other tuna and tuna-like species, less research has been conducted on bigeye tuna. The lack of reasonable estimates of some biological parameters considerably hinders the stock assessment process. The Bigeye Tuna Year Program, which calls for extensive research on bigeye tuna, was adopted in 1996 and began its operation in 1999 as funds became available. Additional information on the life history of Atlantic bigeye tuna can be found in the HMS FMP (Sections 2.2.1 and 6.3.1.2).

2.3.1.2 Most Recent Stock Assessment Data

ICCAT currently manages Atlantic bigeye tuna based on an Atlantic-wide single stock hypothesis. However, the possibility of other scenarios, including north and south stocks, does exist, and should not be disregarded (SCRS 1999b)

Table 2.3.1 Summary Table for Atlantic Bigeye Tuna

Age/size at Maturity	Age 3/~100 cm curved fork length
Spawning Sites	Tropical waters
Current Relative Biomass Level*	SSB_{98}/SSB_{MSY} = 0.57 - 0.63
Minimum Stock Size Threshold	$0.6B_{MSY}$ (age 2+)
Current Relative Fishing Mortality Rate* F_{1998}/F_{MSY}	F_{98}/F_{MSY} = 1.50 - 1.82
Maximum Fishing Mortality Threshold	F_{MSY}
Outlook	Overfished; overfishing is occurring
Management Measures in Place	Minimum sizes; time/area closures for fish aggregating device (FAD) fishing; limit on number of vessels > 24 m length overall (LOA) (not applicable to countries catching less than 2000 mt/year); catch and vessel limit for Chinese Taipei. No specific rebuilding program is in place.

*B/B_{MSY} and F/F_{MSY} ranges are ranges of estimates from different model formulations rather than confidence intervals around an estimate.

2.3.2 ATLANTIC YELLOWFIN TUNA

The SCRS did not conduct a new stock assessment for Atlantic yellowfin tuna in 1999. The most recent stock assessment was conducted in 1998 and a summary of the status of Atlantic yellowfin tuna can be found in the HMS FMP (Section 2.2.1). The next assessment is scheduled for July 2000.

2.3.2.1 Life History/Species Biology Information

No new life history information is available regarding Atlantic yellowfin tuna, although research on the life history of yellowfin and other Atlantic tunas is currently being conducted and/or funded by NMFS. The HMS FMP (Sections 2.2.1 and 6.3.1.5) includes summary information on the life history of yellowfin tuna.

2.3.2.2 Most Recent Stock Assessment Data

Based on migration patterns, as well as other information (e.g., time-area size frequency distributions and locations of fishing ground), ICCAT currently manages Atlantic yellowfin tuna based on an Atlantic-wide single stock hypothesis.

Table 2.3.2 Summary Table for Atlantic Yellowfin Tuna

Age/size at Maturity	Age 3/~110 cm curved fork length
Spawning Sites	Tropical waters
Current Relative Biomass Level *Minimum Stock Size Threshold*	unknown $0.5B_{MSY}$ (age 2+)
Current Relative Fishing Mortality Rate F_{1997}/F_{MSY} *Maximum Fishing Mortality Threshold*	F_{97}/F_{MSY} = 0.97-1.35 F_{MSY}
Outlook	Stock not overfished, overfishing may be occurring
Management Measures in Place	Minimum sizes; ICCAT recommendation for effective fishing effort not to exceed 1992 levels; recreational retention limit in the United States.

2.3.3 NORTH ATLANTIC ALBACORE TUNA

The SCRS did not conduct a new stock assessment for Atlantic (northern, southern, or Mediterranean) albacore tuna in 1999. The latest stock assessment was conducted in 1998. The HMS FMP includes a summary of the status of the stock of northern Atlantic albacore tuna (Section 2.2.1). The next assessment for both North Atlantic and South Atlantic albacore tuna is scheduled for October 2000.

2.3.3.1 Life History/Species Biology Information

No new life history information is available regarding Atlantic albacore tuna. Please refer to the HMS FMP (Sections 2.2.1 and 6.3.1.4) for more information on the life history of albacore tuna.

2.3.3.2 Most Recent Stock Assessment Data

On the basis of the available biological information, the existence of three stocks of albacore tuna is assumed for assessment and management purposes; northern and southern Atlantic stocks (separated at 5° N) and a Mediterranean stock. The United States primarily fishes on the north Atlantic stock/management unit, with very minor catches (~ 1 mt) of south Atlantic albacore.

Table 2.3.3 Summary Table for the North Atlantic Albacore Tuna

Age/size at Maturity	Age 5/~90 cm curved fork length
Spawning Sites	Subtropical western waters of the Northern Hemisphere
Current Relative Biomass Level *Minimum Stock Size Threshold*	B_{97}/B_{MSY} = 0.47 (0.34 - 0.63) $B_{90\text{-}94}/B_{75\text{-}80}$ = 0.72 *$0.7B_{MSY}$*
Current Relative Fishing Mortality Rate F_{1997}/F_{MSY} *Maximum Fishing Mortality Threshold*	F_{97}/F_{MSY} = 1.39 (uncertain) F_{97}/F_{MAX} = 0.91 $F_{97}/F_{0.1}$ = 1.60 *F_{MSY}*
Outlook	Overfished; overfishing is occurring
Management Measures in Place	Limit number of vessels to average number 1993-1995

2.3.4 WEST ATLANTIC SKIPJACK TUNA

The characteristics of Atlantic skipjack tuna stocks and fisheries make it extremely difficult to conduct stock assessments using current models. Continuous recruitment occurring throughout the year, but heterogeneous in time and area, makes it impossible to identify and monitor individual cohorts. Apparent variable growth between areas makes it difficult to interpret size distributions and their conversion to ages. For these reasons, SCRS did not conduct a stock assessment for Atlantic (west or east) skipjack tuna in 1999, although some estimates were made (SCRS 1999b).

2.3.4.1 Life History/Species Biology Information

No new life history information is available regarding Atlantic skipjack tuna. Please refer to the HMS FMP (Sections 2.2.1 and 6.3.1.4) for more information on the life history of skipjack tuna.

2.3.4.2 Most Recent Stock Assessment Data

The stock structure of Atlantic skipjack tuna is not well known, and two management units (east and west) have been established due to the development of fisheries on both sides of the Atlantic and the lack of transatlantic recoveries of tagged skipjack tuna. U.S. vessels fish on the west Atlantic stock/management unit.

Table 2.3.4 Summary Table for West Atlantic Skipjack Tuna

Age/size at Maturity	Age 1 to 2/~50 cm curved fork length
Spawning Sites	Opportunistically in tropical and subtropical waters
Current Relative Biomass Level *Minimum Stock Size Threshold*	unknown unknown
Current Relative Fishing Mortality Rate F_{1998}/F_{MSY} *Maximum Fishing Mortality Threshold*	unknown F_{MSY}
Outlook	unknown

2.4 Stock Assessment Update: ATLANTIC BILLFISH

2.4.1 Life History/Species Biology Information

A summary of life history information is provided in the Billfish Amendment in Section 3.1.1 and Chapter 4. New information with potential management implications is described below in the following subsections.

The effect of fishing mortality on a particular resource depends in part on the population structure of the species. If localized populations exist, high mortality in one area could lead to a regional collapse. On the other hand, if there is sufficient exchange between geographically distant areas, efforts to restore a stock in one area could be undermined by continued high levels of fishing pressure in another. In work funded by a NMFS grant, the Virginia Institute of Marine Science (VIMS) is nearing completion of a molecular genetic analysis of blue marlin stock structure within the Atlantic Ocean. Between May 1, 1998 and July 31,1999, researchers collected billfish samples from the United States, Brazil, Jamaica, and Ghana and screened them for potentially informative mitochondrial and nuclear DNA markers.

In September, 1999, under a separate NMFS grant, Dr. John Graves of VIMS initiated a new study to examine the genetic relationship between Atlantic and Indo-Pacific sailfish using a suite of high resolution molecular markers. The intent of the study was to document a molecular marker that can be used to discriminate between Atlantic and Indo-Pacific populations. DNA isolated from ten Atlantic and ten Indo-Pacific sailfish are to be analyzed with the following techniques: RFLP or sequence analysis of a region, the mtDNA D-loop, RFLP analysis of at least two nuclear intron loci, and/or analysis of two or more variable microsatellite loci. An identifiable marker provides the ability to distinguish Atlantic istiophorids from conspecific or closely related istiophorids from the Indian and Pacific Oceans, and can be used to aid enforcement of the no-sale provision in the United States for Atlantic billfishes.

2.4.2 Most Recent Stock Assessment Data

No new stock assessments for Atlantic blue marlin, Atlantic white marlin, or west Atlantic sailfish were conducted for the 1999 SCRS report. At the 1998 meeting, ICCAT decided that in order to allow analysis of the 1997 ICCAT recommendation to reduce Atlantic blue and white marlin landings by 25 percent from 1996 levels (to be fully implemented by the end of 1999), the next assessment update should be conducted in 2000 when 1999 data are fully available. In light of this, the SCRS postponed the assessments of Atlantic blue marlin and Atlantic white marlin originally scheduled to be conducted in 1999 until the year 2000. The next stock assessment for west Atlantic sailfish is scheduled for the year 2001. However, at the 1999 meeting, ICCAT expressed concern regarding the incomplete reporting of Atlantic marlin and sailfish landings, particularly for the last two years. The Commission recommended that all countries with blue marlin landings or dead discards report these data to the ICCAT Secretariat so planned assessments can proceed.

Longbill spearfish and sailfish landings have historically been reported together in annual ICCAT landings statistics. The majority of these landings were most likely sailfish; for 1998 the SCRS reported a 2182 mt catch of sailfish/spearfish, only 17 mt of which was identified as spearfish. The SCRS has not completed an assessment of longbill spearfish in the Atlantic due to the lack of data. Therefore, relative biomass and fishing mortality levels are unavailable. The Billfish Amendment details the final action prohibiting the retention of longbill spearfish in Section 3.4.2. This measure was selected as a result of the paucity of biological data, the rarity of a recreational angler encounter with spearfish, and adherence to a precautionary management strategy.

The most recent ICCAT stock assessments for Atlantic blue and white marlin were conducted in Miami, Florida in July 1996, and included data through 1995. The last assessment for West Atlantic sailfish/spearfish was submitted to the SCRS in 1993 and was based on data collected through 1991. Stock abundance estimates for Atlantic billfish were based on non-equilibrium production models using catch per unit of effort data. Section 2.1.1 of the Billfish Amendment describes the status of the stocks based on those assessments. A summary is also provided in Table 2.4.1.

ICCAT recommended in 1997 that additional detailed analyses of the available blue and white marlin data be conducted and that alternative assessment methodologies be explored in order to improve the 1996 assessments. A document presented at the 1997 International Symposium on Fishery Stock Assessment Models for the 21st Century provided a case history of stock production models of blue marlin and white marlin in the Atlantic, along with approaches that enabled specific problems to be addressed when applying the production model (Jones *et al.*, 1998).

Table 2.4.1 Summary Table for Atlantic Billfish*

	Atlantic Blue Marlin	**Atlantic White Marlin**	**West Atlantic Sailfish**
Age/size at Maturity	2-4 years Females: 193 cm Males: 175 cm	Unknown Females: 155 cm Males: 140 cm	3 years Females: 157 cm Males: 122 cm
Spawning Sites	Tropical and subtropical waters in the summer and fall	Tropical and subtropical waters in the mid- to late spring	Tropical and subtropical waters in the spring through summer
Current Relative Biomass Level *Minimum Stock Size Threshold*	B_{96}/B_{MSY} = 0.24 $0.9B_{MSY}$	B_{96}/B_{MSY} = 0.23 $0.85B_{MSY}$	$B_{92\text{-}96}/B_{MSY}$ = 0.62 $0.75B_{MSY}$
Current Relative Fishing Mortality Rate F_{1997}/F_{MSY} *Maximum Fishing Mortality Threshold*	F_{95}/F_{MSY} = 2.87 (1.45-3.41) F_{MSY}	F_{95}/F_{MSY} = 1.96 (1.33-2.91) F_{MSY}	$F_{91\text{-}95}/F_{MSY}$ = 1.4 F_{MSY}
Outlook	Overfished; overfishing is occurring	Overfished; overfishing is occurring	Overfished; overfishing is occurring
Management Measures in Place	Reduce landings by 25 percent from 1996 levels; No specific rebuilding program.	Reduce landings by 25 percent from 1996 levels; No specific rebuilding program.	None at present

*Longbill spearfish are considered Atlantic billfish, but are not included in this table due to the lack of data. The SCRS has yet to complete an assessment of longbill spearfish in the Atlantic and relative biomass and fishing mortality levels are unavailable.

2.5 Stock Assessment Update: ATLANTIC SHARKS

2.5.1 Life History/Species Biology Information

There are several research projects underway regarding Atlantic sharks detailed in the Comprehensive Research and Monitoring Plan for Atlantic Highly Migratory Species (Appendix I). A general discussion of shark characteristics can be found in the HMS FMP (2.4.1). Previously released life history information concerning the thirty-three shark species recently added to the shark management unit can be found in the Essential Fish Habitat section of this report (3.1).

2.5.2 Most Recent Stock Assessment Data

No new stock assessments were conducted for Atlantic sharks this year. The stock assessment information used in the HMS FMP came primarily from the 1998 Shark Evaluation Workshop. Detailed information can be found in Section 2.4 of the HMS FMP. In general, there remains a good deal of uncertainty regarding shark stocks and mortality. Due to most shark species' inability to withstand intense exploitation, precautionary approaches were used in adherence with Magnuson-Stevens guidelines.

The SCRS Subcommittee on Bycatch met in Messina, Italy, from May 11-14, 1999. The meeting was attended by scientists representing Brazil, Spain, Italy, Portugal, France, Japan, the United Kingdom, the United States, and the ICCAT Secretariat. There were 12 working papers presented (6 of which were submitted by the U.S. delegation) and 7 reference papers presented on various aspects of shark (or other) species bycatch in the Atlantic and Mediterranean (or associated) tuna fleets.

The focus of the meeting was to discuss progress made by ICCAT on data collection for sharks from the Atlantic tuna or tuna-like fisheries. Thus far, only 19 of the more than 80 nations, entities, and fishing entities have reported any catch and effort data on sharks to ICCAT and few have reported any size frequency data. The Subcommittee continues to observe that the shark data reporting response level by member and non-member countries is poor and may reflect the relatively low priority various nations, entities, and fishing entities place on monitoring the catches and by-catches of these species. The statistical data on sharks available through ICCAT is not sufficient to conduct stock assessments through normally applied methods which relate catch and effort patterns. It is unlikely that sufficient catch and effort data for more traditional stock assessments will in fact exist through the present ICCAT data collection scheme, even if complete reporting by the member and non-member nations comes about. The ICCAT data collection scheme is generally limited to sharks taken as bycatch in the Atlantic and Mediterranean tuna fleets which likely represents only a small fraction of the total fisheries removals for all but a few of these species.

The Sub-Committee concluded that if the Commission wishes that SCRS conduct stock assessments and provide fishery management advice for sharks, the Commission needs to make

this clear by changing the mandate of ICCAT relative to this issue. This will likely require modification in the level and amount of ICCAT Secretariat staff for data collection, since if the Commission considers stock assessments for sharks necessary, changes in the levels and amounts of data collection by ICCAT will be required. The Subcommittee also concluded that the Food and Agriculture Organization of the United Nations' (FAO) International Plan of Action for Sharks does not require any modifications to functions of ICCAT. FAO is still considered by the Sub-Committee to be the focal point for total shark catch statistics compilations and the ICCAT mandate is still limited to statistics related to sharks caught by the Atlantic and Mediterranean tuna fleets (either as by-catches or sometimes even as target species).

The most recent stock assessment for small coastal sharks was conducted in 1993. A small coastal shark survey may be funded outside of NMFS to assess current stock size, fishing mortality rates, and recent life history information. The grant has been applied for and has been recommended for funding, subject to sufficient funds being available.

Table 2.5.1 Summary Table for Atlantic Sharks

	Blacktip Sharks	**Sandbar Sharks**	**Large Coastal Sharks (all species)**	**Small Coastal Sharks**	**Pelagic Sharks**
Current Relative Biomass Level	N_{98}/N_{MSY}=0.50 (baseline) N_{98}/N_{MSY}=0.48 (alternative)	N_{98}/N_{MSY}=0.58 (baseline) N_{98}/N_{MSY}=0.70 (alternative)	N_{98}/N_{MSY}=0.30 (baseline) N_{98}/N_{MSY}=0.36 (alternative)	B_{91}/B_{MSY} = 1.12	unknown
Minimum Stock Size Threshold	$0.9B_{MSY}$	$0.9B_{MSY}$	$0.9B_{MSY}$	$0.9B_{MSY}$	unknown
Current Relative Fishing Mortality Rate F_{1998}/F_{MSY}	F_{97}/F_{MSY} = 3.52 (baseline) F_{97}/F_{MSY} = 3.74 (alternative)	F_{97}/F_{MSY} = 2.70 (baseline) F_{97}/F_{MSY} = 1.62 (alternative)	F_{97}/F_{MSY} = 6.34 (baseline) F_{97}/F_{MSY} = 6.03 (alternative)	$F_{86\text{-}91}/F_{MSY}$ = 0.89	unknown
Maximum Fishing Mortality Threshold	F_{MSY}	F_{MSY}	F_{MSY}	F_{MSY}	unknown
Outlook	Overfished; overfishing is occurring	Overfished; overfishing is occurring	Overfished; overfishing is occurring	Stock not overfished; overfishing is not occurring	unknown
Management Measures in Place	Quotas, trip limits, minimum sizes, prohibited species, bag limits.				

Section 2 References:

Arocha, F. 1997. The reproductive dynamics of swordfish *Xiphias gladius* L. and management implications in the northwestern Atlantic. University of Miami, Ph.D. Dissertation. Coral Gables, FL. 383 pp.

Jones, C. D., Prince, E. P., Scott, G.P., and M. I. Farber. 1998. Stock Production Models of Blue Marlin and White Marlin in the Atlantic Ocean: A Case History. Miami Laboratory Contribution MIA-97/98-01.

NMFS. 1998. 1998 Report of the Shark Evaluation Workshop. 109 pp.

NMFS. 1999a. Final Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks.

NMFS. 1998b. Amendment 1 to the Atlantic Billfish Fishery Management Plan.

SCRS. 1999a. Detailed Report for Swordfish, ICCAT SCRS Swordfish Stock Assessment Session, October 9, 1999, 176 pp.

SCRS. 1999b. Report of the Standing Committee on Research and Statistics, ICCAT SCRS, October 11-15, 1999.

SCRS. 1999c. 1999 Detailed Report for Atlantic Blue Marlin, White Marlin, and Sailfish , ICCAT.

VIMS (Grant #NA86FM0379). Molecular Genetic Analysis of Blue Marlin Stock Structure within the Atlantic Ocean.

VIMS (Grant #NA96FM0496). Development of a Molecular Marker to Discriminate between Atlantic and Indo-Pacific Sailfish.

3. ESSENTIAL FISH HABITAT

Section 303(a)(7) of the Magnuson-Stevens Act, 16 U.S.C. §§ 1801 *et seq*., as amended by the Sustainable Fisheries Act in 1996, requires that Fishery Management Plans (FMPs) describe and identify essential fish habitat (EFH) within the U.S. Exclusive Economic Zone (EEZ) for all life stages of each species in a fishery management unit. Available information should be evaluated through a hierarchical analysis based on: 1) presence/absence of the species in specific habitats; 2) habitat-related densities or relative abundances; 3) growth, reproduction, or survival rate comparisons between habitats; and 4) habitat-dependent production rates (quantified by habitat quantities, qualities and specific locations). This information should be interpreted with a risk-averse approach to ensure that adequate areas are protected as EFH for the managed species. The HMS FMP addresses EFH for species managed under that plan in Chapter 6.

3.1 Atlantic Sharks

Thirty-three shark species were added to the management unit in the HMS FMP in order to prohibit finning on all species of shark. Many of these species are small, deep-water species rarely targeted in HMS fisheries. However, some are taken incidentally in directed shark, tuna, or swordfish fisheries, while others, such as the smooth dogfish, are the targets of directed fisheries.

Determining EFH is a lengthy and data-dependent process. Sections 6.22 and 6.23 of the HMS FMP detail the process used to determine EFH for Atlantic Sharks as well as the general methodology and data sets used to designate EFH. In general, there are few data on the life history and fishery interactions of these thirty-three shark species. This paucity of data creates significant challenges in constructing accurate EFH descriptions. NMFS is currently using Geographic Information Systems (GIS) to analyze all available data for these species. Results and complete EFH descriptions are expected by early 2000 and will be issued in an Addendum to this document. Presented below are life history summaries for the shark species. The following descriptions are taken predominantly from Castro (1983), and supplemented with material from Compagno (1984).

BRAMBLE SHARKS (Echinorhinidea)

Bramble shark *Echinorhinus brucus*

The bramble shark is a large, sluggish, bottom dwelling shark. It is primarily a deepwater species, thought to be widely distributed in the deep temperate and tropical waters of continental and insular shelves and upper slopes. Although this shark appears most abundant in depths of 350-900 meters, it is occasionally found in shallow water. Bramble shark catches are often reported in the eastern Atlantic and western Indian Oceans, but only three specimens have been reported from the North American east coast in the past hundred years. Reports of specimens from the west coast are doubtful due to high incidences of species misidentification.

Biology: Very little is known about the habits of the bramble shark. Development is ovoviviparous and a litter of 24 pups has been reported. Pups are approximately 40 cm (16 in) at birth and reach a maximum size of 245 cm (96 in).

Fishing: The bramble shark is most often caught in depths greater than 200 meters.

DOGFISH SHARKS (Squalidae)

Lined lanternshark *Etmopterus bullisi*

The lined lanternshark is a small, slender shark that inhabits the western Atlantic Ocean. It is a deep-water species, usually found along the continental slope from North Carolina to the Caribbean Sea in water 350-650 meters deep.

Biology: The lined lanternshark feeds on small crustaceans and squid. It is capable of swallowing relatively large squid whole, possibly by distending its jaws. Although development is presumed to be ovoviviparous, nothing else is known of its reproduction. The specimens collected have been juveniles between 18-24 cm (7-9 in). The size range for an adult is not yet known.

Fishing: The lined lanternshark can be caught in deep-water trawls.

Broadband dogfish *Etmopterus gracilispinis*

Broadband dogfish catches have been reported from the western North Atlantic Ocean (off Virginia and Florida) and from both sides of the South Atlantic Ocean. This shark is assumed to be widely distributed in the Atlantic along the outer continental shelf and upper slope at depths ranging from 400-600 meters. Like several other small, deepwater species, it is believed to ascend in the water column at night. Nothing else is known of its habits.

Biology: Development is probably ovoviviparous. A newborn specimen measuring 13 cm (5 in) has been reported, and a 26 cm (10 in) male was determined to be immature. Specimens of broadband dogfish have been recorded at 33 cm (13 in).

Fishing: The broadband dogfish can be caught in deep-water trawls.

Caribbean lanternshark *Etmopterus hillianus*

The Caribbean lanternshark is a small shark found in the Caribbean and the Atlantic Ocean ranging from southern Florida to the Chesapeake Bay. It appears to be confined to deep water of the upper continental and insular slopes and has been reported from depths of 350-700 meters. Nothing else is known of its habits.

Biology: Development is ovoviviparous. Males and females reach maturity at about 25 cm (10

in) and 30 cm (12 in), respectively. Litters consist of up to five pups, around 9 cm (4 in) in length at birth. Average size is about 25 cm (10 in) and sharks have been reported at 32 cm (13 in).

Fishing: The Caribbean lanternshark can be caught in deep-water trawls.

Great lanternshark *Etmopterus princeps*

The great lanternshark is a small, slender shark found throughout the North Atlantic Ocean. It is common from southern Nova Scotia to southern New England. Confined to deep waters of the continental slopes, the great lanternshark has been reported from depths of 550 to over 2000 meters.

Biology: Little is known about the habits and diet of this species. Development is presumed to be ovoviviparous. A 55 cm (22 in) male was reported as mature and individuals have been reported at a length of about 75 cm (30 in).

Fishing: The great lanternshark has been caught only in deep-water trawls.

Smooth lanternshark *Etmopterus pusillus* and *Etmopterus bigelowi* (formerly one species; *Etmopterus pusillus*)

The smooth lanternshark is a small, deep water shark reported throughout the North and South Atlantic Ocean. It is thought to be well distributed in deep water along the continental slopes with most specimens caught at depths around 450 meters.

Biology: The smooth lanternshark is known to feed on squid, other small sharks, and small bony fishes. Reproductive processes have not been described, however, males up to 39 cm (15 in) and females up to 47 cm (19 in) have been reported as immature. Average size is about 45 cm (18 in) and the largest specimen on record measured 47 cm (19 in).

Fishing: The smooth lanternshark can be caught in deep-water trawls.

Fringefin lanternshark *Etmopterus schultzi*

The fringefin lanternshark is a small, deep water shark found in the northern Gulf of Mexico. It appears to be common along upper continental slopes at depths ranging from 400-750 meters.

Biology: The species is known to feed on squid. No data on its reproductive development are available. The average size of a fringefin lanternshark is about 27 cm (11 in), with some specimens reaching 30 cm (12 in) in length.

Fishing: The fringefin lanternshark can be caught in deep-water trawls.

Green dogfish *Etmopterus virens*

The green dogfish is only found in the northern Gulf of Mexico, where it is relatively common. It appears to live in dense schools confined to moderately deep waters, typically 350-450 meters.

Biology: The green dogfish feeds primarily on squid or octopus. The cephalopod beaks and eyes commonly found in stomach contents are large enough to indicate that the shark's jaws must have been greatly stretched at the time of swallowing. It has been suggested that dense schools of these sharks attack prey much larger than themselves, biting off chunks with their sharp lower teeth. Development is ovoviviparous and the gestation period is believed to last around one year. Litters consist of one to three pups which measure nearly 9 cm (4 in) at birth. Maturity is reached at about 19 cm (7 in) and the average size is 20-25 cm (8-10 in). The largest observed green dogfish have been recorded at 30 cm (12 in).

Fishing: The green dogfish can be caught in deep-water trawls.

Japanese gulper shark (or Needle dogfish) *Centrophorus acus*

The Japanese gulper shark is a little-known deep-water species. It is presumed to be located in the western North Atlantic Ocean at depths below 200 meters.

Biology: Males reach maturity at approximately 81 cm.

Gulper shark *Centrophorus granulosus*

The gulper shark is a deep-water species found along the outermost continental shelves and upper slopes. Specimens have been caught in trawls in the western Atlantic from the Carolinas to the Gulf of Mexico at depths around 350 meters. Although the gulper shark is widely distributed in the Atlantic, it is rarely encountered in the U.S. EEZ, and little is known of its habits.

Biology: Development is ovoviviparous, with litters consisting of four to six pups measuring approximately 35 cm (14 in) at birth. Average size and weight is about 150 cm (59 in) and 27 kg (60 lb) and individuals can reach 182 cm (72 in) in length.

Fishing: The gulper shark is most often caught in deep-water trawls.

Little Gulper Shark *Centrophorus uyato*

The little gulper is a small, slender shark that inhabits continental slopes in the Gulf of Mexico. The typical range is 200-900 meters, although individuals have been reported at depths as shallow as 50 meters and as deep as 1,400.

Biology: Its diet and habits are largely unknown. The largest recorded length for a little gulper is 98 cm (39 in).

Fishing: The little gulper shark is most often in deep-water trawls.

Roughskin spiny dogfish *Squalus asper*

The roughskin spiny dogfish is widely distributed in deep water of the upper continental slope. Most specimens have been isolated captures in the Gulf of Mexico or off of South Carolina in waters 200-650 meters deep.

Biology: The roughskin spiny dogfish is a poorly described species. Its diet includes squid and small fishes, but nothing else is known of its habits. Development is ovoviviparous, with litters of 21 and 22 pups reported. Although size at maturity has not been determined, specimens 85 cm (33 in) long have been reported as mature. Average size is around 90 cm (35 in) and individuals can reach at least 118 cm (46 in) in length.

Fishing: The roughskin spiny dogfish has been caught with both hook and line and trawling gear in deep waters.

Blainville's dogfish *Squalus blainvillei*

Blainville's dogfish are found throughout deep tropical and temperate waters along the continental shelves and upper slopes. Catches have been reported in the Gulf of Mexico, typically from bottom trawls, at depths ranging from 350-750 meters.

Biology: The habits of Blainville's dogfish are poorly known. Diet includes crustaceans, squid, and small fishes. Development is ovoviviparous with a two year gestation period. Litters typically consist of six pups that measure 22-26 cm (9-10 in) at birth and reach maturity at 60-70 cm (24-28 in). Average size is about 75 cm (30 in) and individuals can reach 100 cm (39 in) in length.

Fishing: Blainville's dogfish are most often caught in mid-water or bottom trawls.

Cuban dogfish *Squalus cubensis*

The Cuban dogfish inhabits the Gulf of Mexico, the Caribbean, and Atlantic waters from North Carolina to Florida. It is a bottom-dwelling species found along the continental shelf and uppermost slopes, forming dense schools at 100-350 meters.

Biology: The habits and diet of this shark have not yet been reported. Development is ovoviviparous, with observed litters of 10 embryos. Average size is 75 cm (30 in) and individuals can reach 110 cm (43 in) in length.

Fishing: The Cuban dogfish is caught in bottom trawls at depths greater than 50 meters. It is harvested for its liver, used in the production of oil and vitamins.

Flatnose gulper shark (or Arrowhead dogfish) *Deania profundorum*

The flatnose gulper shark is a poorly known deep water species, assumed to be widely distributed in bottom waters of the upper continental slope. It has been reported at depths of 300-1,800 meters.

Biology: This species is known to feed on crustaceans, squid, and lanternfishes. Embryos have not been described, although development is probably ovoviviparous. Males reach maturity at approximately 70 cm (28 in). Average size is about 50 cm (20 in) and individuals can reach a maximum size of 76 cm (30 in).

Fishing: The flatnose gulper shark is caught in deep-water trawls.

Portuguese shark *Centroscymnus coelolepis*

The Portuguese shark is found from the Grand Banks to Delaware Bay, although few catches have been reported in North American waters. This shark inhabits very deep waters along the continental slope ranging from depths of 350-2,700 meters. Most captures occur at depths greater than 900 meters at a temperature between 5-6°C (41-43°F).

Biology: Stomach contents of Portugese sharks consist mainly of small fishes. Development is ovoviviparous, with average litters of 13-15 pups measuring 27-30 cm (11-12 in) at birth. Average size is 90-107 cm (35-42 in) and the maximum size is estimated at 120 cm (47 in).

Fishing: The majority of Portugese shark specimens were caught on halibut lines at depths greater than 350 meters.

Greenland shark *Somniosus microcephalus*

The Greenland shark is a large, wide-bodied shark commonly found in North American waters from Baffin Bay to the Gulf of Saint Lawrence. Individuals have been reported in the Gulf of Maine and as far south as Cape Hatteras. This is the only shark species regularly encountered in the polar waters of the Atlantic Ocean, where average temperatures are 2-7°C (35-45°F). In the summer, the Greenland shark tends to reside at depths of 200-750 meters, although some have been caught as deep as 1,100 meters. During the winter months, the species moves up the water column, often approaching the surface at the edge of the ice.

Biology: The Greenland shark feeds on capelin, char, halibut, herring, lumpfish, salmon, numerous other fishes, and seals. This species often gathers in large numbers around sealing or whaling operations, feeding on offal or carrion. Very little is known about the reproductive processes of this shark, presumed to be oviparous until a few years ago. Development is now thought to be ovoviviparous. Pups measure about 38 cm (15 in) at birth and up to 10 pups have been reported in one litter. Tagging studies have shown the Greenland shark to be a very slow-growing fish; medium-size specimens appear to grow only 1 cm (0.4 in) or less per year. Average size is 340 cm (11.1 ft) and 285 kg (627 lb) and the largest specimen on record measured 640 cm (21.0 ft) and weighed 1,022 kg (2,250 lb).

Fishing: The Greenland shark has been fished for its liver oil along the coasts of Norway, Iceland, and Greenland. In Greenland it is targeted using longlines in 250-550 meter water. In the winter, fishermen often use light to lure sharks to the surface where they tend to be extremely sluggish and offer little resistance.

Kitefin shark *Dalatias licha*

The kitefin shark is a small, deep-water shark, usually found over the outer continental and insular shelf and slope at depths of 250-600 meters. This species is rarely found off North American coasts; only catches in Georges Bank and the Gulf of Mexico have been reported. Catch records in the Mediterranean suggest that the kitefin is primarily a solitary shark, and does not exhibit schooling behavior.

Biology: The kitefin shark is a versatile deep-sea predator and feeds on numerous bony fishes, rays, crabs, and squid. Adults tend to consume more crustaceans and sharks and fewer cephalopods than do juveniles and rely heavily on sharks as an alternative food source in the spring and winter. Development is ovoviviparous and litters consist of 10 to16 pups 30 cm (12 in) in length. Males are estimated to reach maturity at 95 cm (37 in), with females maturing at 120 cm (47 in). Average size and weight is about 120 cm (47 in) and 8 kg (18 lb) and the largest specimen on record measured 182 cm (72 in).

Fishing: The kitefin shark is most often taken in deep-water trawls or on longlines.

Cookie-cutter shark *Isistius brasiliensis*

The cookie-cutter shark inhabits the deep waters of the tropical and subtropical belts of the Atlantic, Pacific, and Indian Oceans. The only reported catches near the United States come from the area north of the Bahamas. It is a very small shark species usually characterized as epipelagic to bathypelagic (epipelagic refers to the zone of the ocean where light can penetrate and photosynthesis occurs; bathypelagic refers to the ocean depths, typically 60-3,600 meters). Most catches occur after dark between the surface and 550 meters, indicating a possible nighttime vertical migration from deeper water. The species is also thought to exhibit schooling behavior.

Biology: The cookie-cutter shark has very powerful jaws and large teeth. It feeds extensively on large squid, but may also attack even larger prey. Evidence indicates that it feeds by taking bites from large pelagic fishes (tunas, wahoo, dolphin, marlins, etc.) as well as porpoises and whales. It has been suggested that the shark is able to grab a quick bite after being approached, and subsequently rejected, by larger animals in search of prey. The ventral surface of the head and body (except for the dark collar around the gill area), as well as the ventral fin surfaces, are luminescent, and emit a bright greenish glow. The number of light organs is highly variable; some specimens may have very few or emit no light at all. Cookie-cutter development is presumed to be ovoviviparous. Six or seven large eggs have been reported from females, but embryos have not been reported as of yet. Females mature at 40 cm (16 in) and males are thought to reach maturity around 37 cm (15 in). The cookie-cutter shark ranges in size from 14-50 cm (6-20 in);

the largest on record is 50 cm (20 in).

Fishing: The cookie-cutter shark can be caught on surface and in mid-water trawls after dark. It does not appear to be attracted to lights.

Bigtooth (or Largetooth) cookie-cutter shark *Isistius plutodus*

The bigtooth cookie-cutter is a small shark characterized as epipelagic and possibly bathypelagic. Catches have been reported in the Gulf of Mexico.

Biology: The habits of the bigtooth cookie-cutter are presumed to be similar to those of the cookie-cutter shark. However, its more powerful jaws, bigger mouth, and gigantic lower teeth (proportionately the largest of any living shark) enable it to take larger bites out of its prey. In addition, its short snout and anteriorly positioned eyes allow for binocular vision, and may be useful in locating prey. There are no data available on reproduction and the maximum size of this species has been estimated at 42 cm (17 in).

Fishing: A bigtooth cookie-cutter shark specimen was caught in a mid-water trawl.

Pygmy shark (or Spiny Pygmy shark) *Squaliolus laticaudus*

The pygmy shark is a minute, cigar-shaped shark. The species is wide ranging, inhabiting temperate and tropical waters at depths ranging from 200-500 meters. Pygmy sharks tend to undergo diurnal vertical migrations, migrating upward to depths of 200 meters at night to feed.

Biology: The pygmy shark is known to feed on squid, lanternfishes, and lightfishes. Although embryos have not been observed, development is presumed to be ovoviviparous. Males reach maturity at 15-22 cm (6-9 in), while females mature at 17-20 cm (7-8 in). The shark is the smallest on record with an average size of 15-22 cm (6-9 in) and a maximum size of about 27 cm (11 in).

Fishing: The pygmy shark can be caught in mid-water trawls at depths of 200-500 meters.

Smallmouth velvet dogfish *Scymnodon obscurus*

The smallmouth velvet dogfish is a little-known deepwater shark found on or near the bottom of the continental slopes at depths of 550 to 1,450 meters.

Biology: This species preys on bottom fishes and invertebrates and is assumed to be ovoviviparous. Maximum total lengths for adults are 51 cm and 59 cm for males and females, respectively.

Fisheries: Smallmouth velvet dogfish have been reported caught in bottom trawls, with line gear, and with fixed bottom nets in the eastern Atlantic.

SAWSHARKS (Pristiophoridae)

American sawshark *Pristiophorus schroederi*

The American sawshark is a poorly known deep-water species, inhabiting waters of the continental and insular slopes. The limits of its distribution are unknown. The only positively identified specimens have come from waters off southeast Florida and the Bahamas, although the species appears to be locally common in deep water around Cay Sal Bank. What reported catches there are have occurred in water 650-950 meters deep.

Biology: The American sawshark is easily recognized by its snout, which is prolonged into a long flat blade. The snout is equipped with "teeth", or enlarged dermal denticles, on each side and two long barbels on the underside. The American sawshark is not to be confused with the sawfish, the latter being a shark-like ray of the batoid family Pristidae. However, the sawshark may use its saw to stun and disable prey just as sawfishes do. Development is assumed to be ovoviviparous and newborns measure in at 30 cm (12 in). The largest American sawshark specimen was recorded at 81 cm (32 in) in length.

Fishing: The American sawshark can be caught in deep-water trawls.

CATSHARKS (Scyliorhinidae)

Iceland catshark *Apristurus laurussonii*

The Iceland catshark has been reported off the New England coast, the Gulf of Mexico, and the Caribbean. The limits of its distribution are unknown, but it appears to be widespread in deep water and commonly found in deep water off the Gulf of Mexico. Reported catches in the Gulf of Mexico and Caribbean have come from depths of 900-1450 meters.

Biology: The habits and diet of the Iceland catshark are unknown. There are no data available on its reproduction.

Fishing: Icelandic catsharks have been caught only in deep-water trawls.

Smallfin catshark *Apristurus parvipinnis*

The smallfin catshark inhabits the upper continental and insular slopes of the Gulf of Mexico and the Caribbean Sea. It is commonly found in deep water in the Gulf of Mexico where specimens have been collected at depths ranging from 650-1100 meters.

Biology: Average size is 45-50 cm (18-20 in). No other information is available.

Fishing: The smallfin catshark can be caught in deep-water trawls.

Deepwater catshark *Apristurus profundorum*

The deepwater catshark inhabits waters of the continental slopes. It has been caught off Delaware Bay at a depth of 1,500 meters.

Biology: The average size of this small shark is on the order of 50 cm (20 in). There is no other information available on this species.

Fishing: The deepwater catshark can be caught in deep-water trawls.

Broadgill catshark *Apristurus riveri*

The broadgill catshark inhabits deep waters in the Gulf of Mexico and the Caribbean Sea. Specimens have been collected at depths ranging from 650-1,100 meters.

Biology: Little is known of the habits of broadgill catshark. Development is oviparous and egg cases are smooth-surfaced, translucent, greenish with indistinct bands of lighter color, and measure about 5.5 cm (2 in) long by 1.3 cm (0.5 in) wide. Females are believed to mature at 40 cm (16 in), and males are thought to mature at a slightly larger size. Average adult size is 42 cm (17 in), with the largest recorded specimen measuring 48 cm (19 in).

Fishing: The broadgill catshark can be caught in deep-water trawls.

Marbled catshark *Galeus arae*

The marbled catshark is a small, slender shark that inhabits bottom waters along the continental slopes from Georgia southward to the eastern Gulf of Mexico and Colombia. It is common throughout its range, although distribution is irregular, and inhabits waters 300-750 meters deep with a temperature range of 6-11°C (43-52°F). Adults have been found to reside in deeper water than juveniles.

Biology: The marbled catshark feeds on various species of deep-water shrimp. The type of development has not yet been determined, but is believed to be ovoviviparous due to the presence of eggs without cases found inside a female. Gravid females are very seldom seen, although large numbers of females have been caught. Maturity is reached at about 27cm (11 in) and the average size is around 35 cm (14 in). Maximum size is estimated at 40 cm (16 in).

Fishing: The marbled catshark is most often caught in deep-water shrimp trawls.

Blotched catshark *Scyliorhinus meadi*

The blotched catshark is a small shark inhabiting the western Atlantic Ocean from North Carolina

to Cuba. Its limits of distribution are not well known, however, specimens have been trawled from depths of 350-550 meters.

Biology: The few specimens collected have all been immature, ranging from 18-49 cm (7-19 in). One specimen was reported with cephalopod beaks in its stomach, indicating squid as an important prey item. Development is probably oviparous, but little is known about the reproduction and biology of this species.

Fishing: The blotched catshark is most often caught in deep-water shrimp trawls.

Chain dogfish (or Chain catshark) *Scyliorhinus retifer*

The chain dogfish is a small, slender catshark that inhabits the waters of the Gulf of Mexico and the western Atlantic Ocean from Georges Bank to Nicaragua. It is a bottom-dwelling species found in the deep waters of the continental shelf and slope, usually in temperatures near 10°C (50°F). The species appears to be most abundant in deep waters off Virginia and North Carolina. It is occasionally taken at depths of 40-200 meters in the northern parts of the range, but inhabits deeper waters (450 meters or more) further south.

Biology: Development is oviparous. Pregnant females have seldom been taken, but the egg cases are believed to be 5-6 cm (2 in) long by 2 cm (0.9 in) wide, brownish/amber in color, and possess a long tendril at each corner. The pups measure about 10 cm (3.9 in) at hatching. One trawl off Cape Hatteras produced a large number of newly hatched or small chain dogfish, suggesting that nursery areas may be highly localized. Average size is about 38 cm (15 in) and the largest recorded chain dogfish measured 47 cm (19 in).

Fishing: The chain dogfish is most often taken by trawling in depths greater than 75 meters and at temperatures around 10°C (50°F).

Dwarf catshark *Scyliorhinus torrei*

The dwarf catfish is a small, slender shark previously collected off the southeast coast of Florida and the Virgin Islands. It is a bottom dwelling species along the upper continental slope, and has been caught at depths of 200-550 meters. However, the extent of this shark's distribution remains unknown.

Biology: Analysis of stomach contents have indicated a diet of squid and possibly cuttlefish. Nothing else is known about its habits and reproduction, as neither eggs nor newly hatched pups have been observed. Average size is 26 cm (10 in) and the largest recorded dwarf catshark measured 29 cm (11 in).

Fishing: The dwarf catshark has been caught only in deep-water trawls.

SMOOTHHOUND SHARKS (Triakidae)

Smooth dogfish *Mustelus canis*

The smooth dogfish has a very slender body and a prominent spiracle behind the eye. In North American waters its range encompasses the Bay of Fundy to Florida as well as the Gulf of Mexico. This is a common shark in bays and inshore waters, usually found at depths of less than 20 meters. It is frequently encountered from Cape Cod to Charleston, where it is the second most abundant shark after the spiny dogfish, *Squalis acanthias*. There is some evidence that this species is divided into several discrete populations. The most well known population is found in the range from the Carolinas north along the coast to New England and southern Canada. The species is relatively uncommon between North Carolina and Florida, but can be found in abundance off the Florida coast. In addition, smooth dogfish catches occur frequently in many areas of the Gulf of Mexico and the Caribbean. Off the Atlantic coast, the species migrates in response to changes in water temperature, moving from north to south with the seasons. They primarily winter in the area between southern North Carolina and the Chesapeake Bay, moving up the coast to New England in the spring. The Caribbean populations inhabit deeper water (typically below 200 meters) and prefer rocky bottoms.

Biology: This species feeds on large crustaceans, including crabs, lobsters, and shrimp. However, the smooth dogfish is both an opportunistic feeder and a scavenger and will consume whatever prey is easily available, including bony fishes and squid. It is primarily nocturnal and tends to be a very active shark, constantly patrolling the bottom for food. Development is viviparous. Pups measure 34-39 cm (13-15 in) at birth, with litters usually consisting of 10 to 20 pups. The gestation period lasts about ten months and most births occur in early summer. The growth rate of this species is believed to be very fast, with maturation occurring after only one or two years at a size of 85 cm (33 in). Average size is about 122 cm (48 in), but individuals as large as 152 cm (60 in) have been reported.

Fishing: The smooth dogfish can be easily taken with hook and line using squid or shrimp bait. Because of its abundance, it interferes with shrimp trawling operations and affects crab and lobster stocks. It is often caught in large numbers by shrimp trawlers. The species is extensively used as a laboratory animal and often displayed in aquaria.

Florida dogfish *Mustelus norrisi*

The very slender Florida dogfish is usually found in shallow coastal waters with sand or mud bottoms. The species typically moves inshore to waters of 5-7 meters or less during the winter months, although specimens have been caught in water as deep as 90 meters. Florida dogfish are common along the west coast of Florida, and have also been reported in the southern Caribbean and the western Atlantic south to Brazil. The limits of distribution are not well known.

Biology: This dogfish feeds on crabs, shrimp, and small fishes. Development is viviparous, with litters in late winter or early spring usually consisting of seven to fourteen pups that measure 30 cm (12 m) at birth. Males reach maturity at about 58 cm (23 in), and females mature at 65 cm (26 in). Average size is 75 cm (30 in) for males and 90 cm (35 in) for females, although

individuals have been reported exceeding 100 cm (39 in) in length.

Fishing: The Florida dogfish is most often taken in fish nets, usually very close to shore.

3.2 Cooperative Atlantic States Shark Pupping and Nursery Survey

*The following material is excerpted from Pratt and McCandless, 1999.

Introduction

The HMS FMP calls for research and information about the EFH of shark species, focusing on shark nurseries. Specifically, it calls for further delineation of summer and winter nursery areas, determining if sharks return to their natal nurseries, determining habitat relationships such as temperature and salinity, determining significance of areas of aggregation, and determining the role of coastal/inshore habitats in supporting neonate and juvenile sharks. Shark nursery areas are frequently located in highly productive coastal or estuarine waters within state boundaries. Studies suggest that these inshore nursery grounds offer selective advantages of low predation rates and high forage abundance. Understanding both primary (where parturition and young-of-the-year sharks occur) and secondary (utilized by juveniles, age 1 + only) coastal shark nursery habitat is critical to effective management and necessary for defining EFH for these species. In 1998, the NMFS Apex Predators Program (APP) formed the Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) Survey, an alliance of state cooperators to investigate shark nursery grounds along the east coast of the United States. The COASTSPAN Survey was designed to provide some answers to the questions raised in the HMS FMP and to use these answers to identify states that should be involved in a potential Atlantic States Marine Fisheries Commission (ASMFC) shark management plan. Cooperative researchers in selected coastal states conducted a comprehensive and standardized investigation of potential shark nursery areas. The North Carolina Division of Marine Fisheries, South Carolina Department of Natural Resources, Savanna State University with cooperation from Georgia Department of Natural Resources, and Florida Department of Environmental Protection participated in 1998. NMFS APP staff conducted the COASTSPAN study in Delaware Bay.

Results represented here are for the first year of a five-year sampling program. The first year of sampling was designed to select suitable locations that are characteristic of local state waters where supposed shark nursery grounds may occur. The second consideration was to test the COASTSPAN gillnet and longline in the selected coastal states to access compatibility with local conditions of tide, current, and boat traffic.

Subsequent years will direct the efforts of state cooperators toward repeating the selected stations, chosen in concert with NMFS staff, using agreed upon gear and methodology. The program will continue the delineation of shark nursery areas, develop relative indices of abundance of neonate and juvenile sharks in these nursery areas, and use the environmental data and bycatch collected to determine habitat relationships. It will also use tag and recapture data to determine if sharks return to their natal nurseries and identify overwintering nursery grounds.

Preliminary 1998 COASTSPAN Findings

The data clearly show that the Delaware Bay is an important pupping and nursery ground for sandbar sharks. COASTSPAN 1998 data suggest that pupping of sandbar sharks occurs in the Bay between mid-June and early September. Tag recapture evidence suggests that neonate sandbar sharks remain in the Delaware Bay nursery for at least three months. Tag recaptures show that some age 1+ juveniles return to the Bay the next year and probably up to six years. The presence of early juvenile sand tiger sharks suggests that Delaware Bay may also be a secondary nursery ground for this species.

Preliminary COASTSPAN results show that North Carolina's coastal waters probably support several shark nursery grounds. Presence of fresh umbilical scars suggest that spinner, dusky, and Atlantic sharpnose sharks utilize these waters as pupping and nursery grounds. COASTSPAN data give supporting evidence that sandbar sharks use North Carolina waters as important overwintering and secondary nursery grounds. Blacknose sharks, blacktip sharks, smooth hammerheads, and scalloped hammerheads utilize these areas as secondary nursery grounds. COASTSPAN data and other records suggest that this area may not be a pupping and nursery ground for the finetooth shark, spiny dogfish, and the Atlantic angel shark. Further sampling, with emphasis in the southeast part of North Carolina, is needed.

South Carolina's coastal waters may also support a variety of shark nursery grounds. Preliminary COASTSPAN findings show that spinner, sandbar, finetooth, and Atlantic sharpnose sharks utilize these waters to some degree as pupping and nursery grounds. The presence of neonates and juveniles from June to September indicates that Bulls Bay, North Edisto Bay and perhaps other parts of South Carolina are pupping and nursery grounds for sandbar sharks. COASTSPAN data support existing evidence that sharpnose sharks utilize Bulls Bay as a pupping and nursery ground and also point out the possibility of North Edisto Bay and Stone Inlet as pupping and nursery grounds. Preliminary data also indicate that blacktip, scalloped hammerhead, and bonnethead sharks utilize South Carolina waters as at least secondary nursery grounds. The apparent lack of neonate and juvenile lemon sharks in South Carolina waters during the 1998 COASTSPAN survey suggest that this area is probably not an important nursery ground area for these species.

COASTSPAN data support the hypothesis that Atlantic sharpnose and bonnethead sharks utilize Georgia's coastal waters as pupping and nursery grounds. These waters may also support secondary nursery ground habitat for scalloped hammerhead and finetooth sharks.

The data contributed to COASTSPAN by the Florida Department of Environmental Protection suggest that Indian River Lagoon is an important secondary nursery ground for bull sharks. More cooperative work is necessary to confirm all of these findings.

4. FISHERY DATA UPDATE

In this document, fishery data, with the exception of some data on Atlantic sharks, are analyzed by gear type. While most HMS fishermen target particular species, the non-selective nature of most fishing gear promotes more effective analysis and management on a gear-by-gear basis. In addition, issues such as socio-economics, bycatch, and safety are more easily addressed by gear type.

The revised list of authorized fisheries (LOF) and fishing gear used in those fisheries became effective December 1, 1999 (64 FR 67511). The rule applies to all U.S. marine fisheries, including Atlantic HMS. As stated in the rule, "no person or vessel may employ fishing gear or participate in a fishery in the exclusive economic zone (EEZ) not included in this LOF without giving 90 days' advance notice to the appropriate Fishery Management Council (Council) or, with respect to Atlantic highly migratory species (HMS), the Secretary of Commerce (Secretary)." Acceptable HMS fisheries and authorized gear types for Atlantic tunas, swordfish, and sharks include: swordfish handgear fishery - rod and reel, harpoon, handline, bandit gear; pelagic longline fishery - longline; shark drift gillnet fishery - gillnet; shark bottom longline fishery - longline; shark handgear fishery - rod and reel, handline, bandit gear; tuna purse seine fishery - purse seine; tuna recreational fishery- rod and reel, handline; tuna handgear fishery - rod and reel, harpoon, handline, bandit gear; and tuna harpoon fishery - harpoon. For Atlantic billfish, the only acceptable fishery and authorized gear type is recreational fishery - rod and reel. Species whose life history characteristics may lead to their eventual categorization as highly migratory, but which are not currently under Secretary of Commerce or Regional Council management authority, are covered in two broad categories: Recreational Fisheries (Non-FMP) and Commercial Fisheries (Non-FMP). Species that fit this description may be harvested with the gears listed for these catchall categories.

Due to the nature of SCRS data collection, Table 4.1 depicts a summary of the U.S. portion of HMS catch and landings by species only rather than species and gear type. International catch levels as well as U.S. reported catches are taken from the 1999 SCRS Report which reflects catch data on a calendar year basis through 1998. The U.S. percentages of regional and total catch for HMS species have remained similar over the past five years and are not depicted here. Historical catch levels dating back to 1950 can be found in the SCRS Report and a discussion of typical species-specific U.S. catch levels can be found in the HMS FMP. International catch and landings tables are included for the longline and purse seine fisheries in Sections 4.1.3 and 4.2.3 of this report. At this point, data necessary to assess the U.S. regional and total percentage of international catch levels for Atlantic shark species are unavailable.

Table 4.1 1998 U.S. vs International Catch of HMS (mt ww). Source: SCRS, 1999

Species	Total International Reported Catch	Region of U.S. Involvement	Total Regional Catch	U.S. Catch	U.S. Percentage of Regional Catch	U.S. Percentage of Total Atlantic Catch
Atlantic Swordfish	31,119 (Atlantic and Mediterranean)	North Atlantic (N.Atl) and South Atlantic (S.Atl)	26,156 (12,175 N.Atl, 13,486 S.Atl)	3,656 (443 mt discards) (3,053 + 433 mt discards N.Atl, 160 +10 mt discards S.Atl)	13.98% (28.67% N.Atl, 1.26% S.Atl)	11.20% (includes Med catches)
Atlantic Bluefin Tuna	44,610	West Atlantic	2,643	1,302 (67 mt discards)	49.26%	2.92%
Atlantic Bigeye Tuna	94,786	Total Atlantic	94,786	928	0.98%	0.98%
Atlantic Yellowfin Tuna	147,434	West Atlantic	25,310	5,621	22.21%	3.81%
Atlantic Albacore Tuna	58,371	N.Atl	25,697	829	3.23%	1.42%
Atlantic Skipjack Tuna	133,181	West Atlantic	30,046	104	0.35%	0.08%
Atlantic Blue Marlin	3,198	N.Atl	1,243	99 (50 mt discards)	7.96%	3.10%
Atlantic White Marlin	1,118	N.Atl	480	34 (32 mt discards)	7.08%	3.04%
Atlantic Sailfish	1,713	West Atlantic	1,542	28 (27 mt discards)	1.82%	1.63%

One of the most important results of the 1999 ICCAT meeting was the acceptance of a 10-year rebuilding program for North Atlantic swordfish. The rebuilding measures primarily affect the pelagic longline fishery, responsible for approximately 98 percent of the U.S. catch. Under the 1999 ICCAT recommendation, there is a dead discard allowance. If the dead discard allowance were to be exceeded, NMFS would reduce the following year's landing quota by the overage. The swordfish rebuilding plan is designed to achieve B_{MSY} in 10 years with a greater than 50 percent probability. Over the next three years, the landings quota and subsequent U.S.

allocation will be progressively reduced. The United States receives 29 percent of the total landings quota and 80 percent of the dead discard allowance. U.S. fishermen are partially responsible for decreasing the amount of dead discards by 100 mt a year over the next three years (detailed in Table 4.2). In addition, the SCRS has been directed to report back in two years on possible measures to reduce the catch of undersize swordfish, including time-area closures and/or gear modifications.

Table 4.2 North Atlantic Swordfish Allocations: ICCAT, 1999.

Country	Share*	2000 allocation (mt)	2001 allocation (mt)	2002 allocation (mt)
European Community	49.85%	5073	5073	5073
United States	29%	2951	2951	2951
Canada	10%	1018	1018	1018
Japan	6.25%	636	636	636
Others	4.9%	498	498	498
Bermuda		24	24	24
Total Catch to be Retained		10,200	10,200	10,200
Dead Discard Allowance		400	300	200
TOTAL		**10,600**	**10,500**	**10,400**

*Share percentage is based on a total catch of 10,176 mt (10,200 - Bermuda's 24 mt allocation).

4.1 Fishery Data: PELAGIC LONGLINE

4.1.1 Overview of History and Current Management

U.S. pelagic longline fishermen began targeting highly migratory species in the Atlantic Ocean in the early 1960s. However, U.S. landings of swordfish did not exceed 1500 mt until the mid-1970s. Since that time, the gear deployed has evolved several times. The majority of fishermen use monofilament mainline that is rigged depending on whether the line is "targeting" tunas or "targeting" swordfish. The term "targeting" is used because there are differences in the location, timing, and gear configuration that are specific to the tuna or swordfish target. For example, tuna fishing tends to occur during the day while most swordfish fishing takes place at night. However, particularly during "swordfish" sets, this gear hooks many different pelagic species incidentally. The incidental catch includes species which are discarded for economic and regulatory reasons. A complete discussion of the pelagic longline fishery can be found in Section 2.5.1 of the HMS FMP.

Bycatch in this fishery is discussed in Section 5.1.6. Like fishermen using other fishing gears, pelagic longline fishermen are subject to minimum sizes for yellowfin, bigeye, and bluefin tuna, and swordfish in order to reduce the mortality of small fish. However, in some areas and at certain times of the year, much of the bycatch in this fishery is released dead. Therefore, NMFS is concerned about reducing bycatch as well as reducing bycatch mortality. Because it is difficult to avoid undersized fish, NMFS has proposed to subject pelagic longline fishermen to time/area closures in the Gulf of Mexico and along the east coast. The intention of these closures is to relocate some of the fishing effort into areas where bycatch is expected to be lower. There is currently in place a time/area closure for pelagic longline fishermen designed to reduce the incidental catch of bluefin tuna. In order to enforce time/area closures, NMFS will require all pelagic longline vessels to report hourly positions on an approved vessel monitoring system (VMS) beginning June 1, 2000. Time/area considerations and VMS are discussed below in Section 5.1.6.

In addition to regulations designed to reduce bycatch, pelagic longline fishermen are subject to quota management for swordfish and sharks, minimum sizes, and a prohibition on directed fishing for bluefin tuna. Quota monitoring requires seasonal regulations, closures, and target catch requirements. In order to document catch and effort, pelagic longline fishermen are subject to permitting and reporting requirements, including logbooks and observer coverage. In 1999, NMFS established a limited entry system for swordfish, shark, and tuna longline permits. Pelagic longline fishermen who target swordfish or BAYS tunas must have a swordfish limited access permit, a limited access shark permit, and a tuna longline permit. NMFS is re-evaluating the limited access program and may consider gear-specific permits in the future. Refer to Section 8 for a discussion of limited access options.

4.1.2 Most Recent Catch and Landings Data

Pelagic longline fishermen encounter as many as 40 different species in a trip. Table 4.1.1 indicates the 1995-1998 catches by U.S. pelagic longline fishermen in the Atlantic Ocean.

Table 4.1.1 **Estimated Pelagic Longline Catches: 1995-1998 (mt ww)***. Source: U.S. National Report (1997, 1998, 1999).

	1995	1996	1997	1998
Swordfish *landings*	3925.7	3627.8	3361.9	3212
Swordfish *dead discards***	525.7	563.7	455.2	432.7
Yellowfin Tuna	3581.6	3285	3773.6	2447.9
Bigeye Tuna	985.5	660.5	794.8	695.3
Bluefin Tuna *landings*	72.6	67.9	49.9	48.7
Bluefin Tuna *dead discards*	141.6	73.5	37.1	64
Albacore Tuna	336.8	109.4	189.1	180.1
Skipjack Tuna	0.8	0.3	3.5	1.3
Blue Marlin***	143.3	196.5	138.1	51.8
White Marlin***	99.7	67.6	70.8	32.1
Sailfish***	59.9	71.6	57.7	27.1

*Atlantic sharks are caught on pelagic longlines, however, the methods for reporting data on Atlantic sharks do not allow for their inclusion in this table.
** Post-release mortality of swordfish released alive is not estimated by NMFS at this time.
***Indicates longline *dead discards* of these species

4.1.3 U.S. vs. International Catch

Table 4.1.2 Estimated International Longline Landings in the Atlantic and Mediterranean: 1995-1998 (mt ww)*. Source: 1999 SCRS Report, U.S. National Report**.**

	1995	1996	1997	1998
Swordfish**	42,589	37,490	35,943	28,173
Yellowfin Tuna	23,199	24,421	21,113	22,993
Bigeye Tuna	74,000	73,660	66,619	58,835
Bluefin Tuna	12,203	14,881	10,250	8,671
Albacore Tuna	24,573	25,436	23,888	28,029
Skipjack Tuna***	37	26	61	77
Blue Marlin****	2,661	3,415	3,434	2,290
White Marlin****	1,395	1,068	814	840
Sailfish****	552	476	376	1,037
Total	**181,159**	**180,873**	**162,498**	**150,945**
US Total	**9,873**	**8,723**	**8,932**	**7,193**
US%	**5.45%**	**4.82%**	**5.50%**	**4.77%**

* landings include those classified by the SCRS as longline landings for all areas
**includes longline landings and *dead discards*
***includes longline and trawl catches for all countries
****includes U.S. longline *dead discards*

The U.S. longline fleet has historically accounted for a small percentage of total Atlantic landings. Even when including U.S. discards for swordfish, blue marlin, white marlin, and sailfish, the U.S. percentage still remains right around 5 percent of all longline landings reported to ICCAT. Swordfish discards have typically accounted for nearly 25 percent of the total swordfish catch (by number) of the U.S. pelagic longline fleet over the past four years (Cramer and Adams, 1999).

4.1.4 Economic Data

The HMS FMP contains baseline economic data for all HMS fisheries. Larkin et al. (1996) provide an overview of the economic aspects of the pelagic longline fishery. They stress that the characteristics of fishing trips vary widely and that distinct fleet sectors must be taken into account when managing this fishery. This is consistent with NMFS' view to manage fisheries holistically, not solely by species. NMFS collects economic and social data on a per trip basis

through submission of voluntary forms in the logbook, but may require this information in the future for selected vessels (64 FR 55900, October 15, 1999).

Pelagic Longline Fishery Economic Study

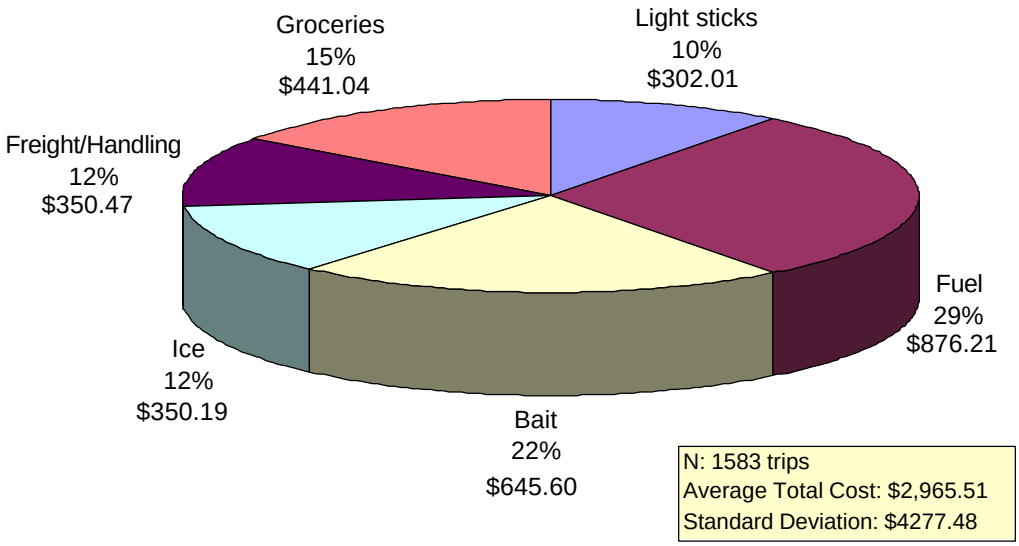
NMFS reported preliminary results from analysis of three years of data from the Atlantic pelagic longline logbook forms (data from set forms and trip summary forms including a voluntary cost component) and weigh-out data at the August 1999 American Fisheries Society meeting (Ward and Hanson, 1999). Table 4.1.3 displays the total number of observations contained in each of the three data sets. The total number of useful observations were reduced when errors and outliers were eliminated. The set and weigh-out forms are required on logbook reporting forms, but the cost portion of the trip summary form is a voluntary submission. All of the following data are reproduced from the Ward and Hanson presentation.

Table 4.1.3 Total Number of Logbook and Weigh-Out Observations. Source: Ward and Hanson, 1999.

	1996	**1997**	**1998**
Set Form	17,996	15,867	N/A
Weigh-Out Form	21,976	21,792	N/A
Trip Summary	1,310	624	383 (incomplete)

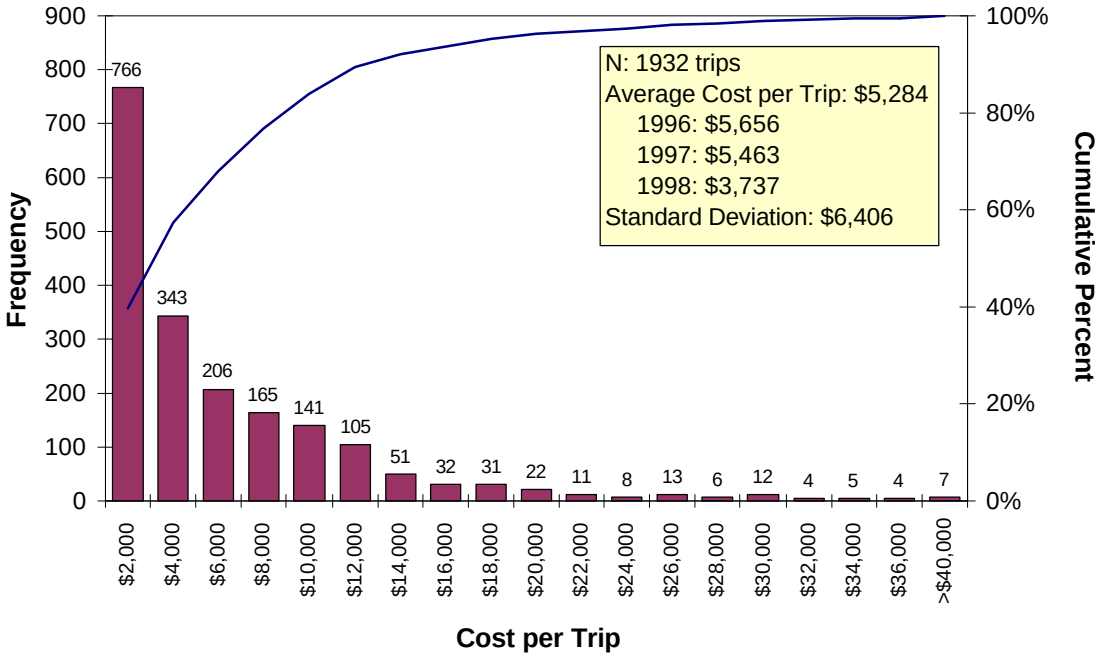
The trip summary form provides estimates of the cost and quantity of inputs used. For those trips where input data were recorded, the average percent and dollar value of total cost broken out by input was calculated. Approximately two-thirds of the calculated total cost of a trip was spent on fuel, bait, and ice (Figure 4.1.1).

Figure 4.1.1 Average Percent and Value of the Cost Components of Longline Fishing Trips: 1996-1997.



The vessel owners/captains were also asked to provide an estimated total cost of the trip on the trip summary form (Figure 4.1.2). In general, there was a difference between the vessel owner/captain reported total cost and the total cost based on inputs. The majority of the trips appeared to be on the lower end of the range of reported trip costs. Higher end trips correspond to distant water trips (destinations far offshore).

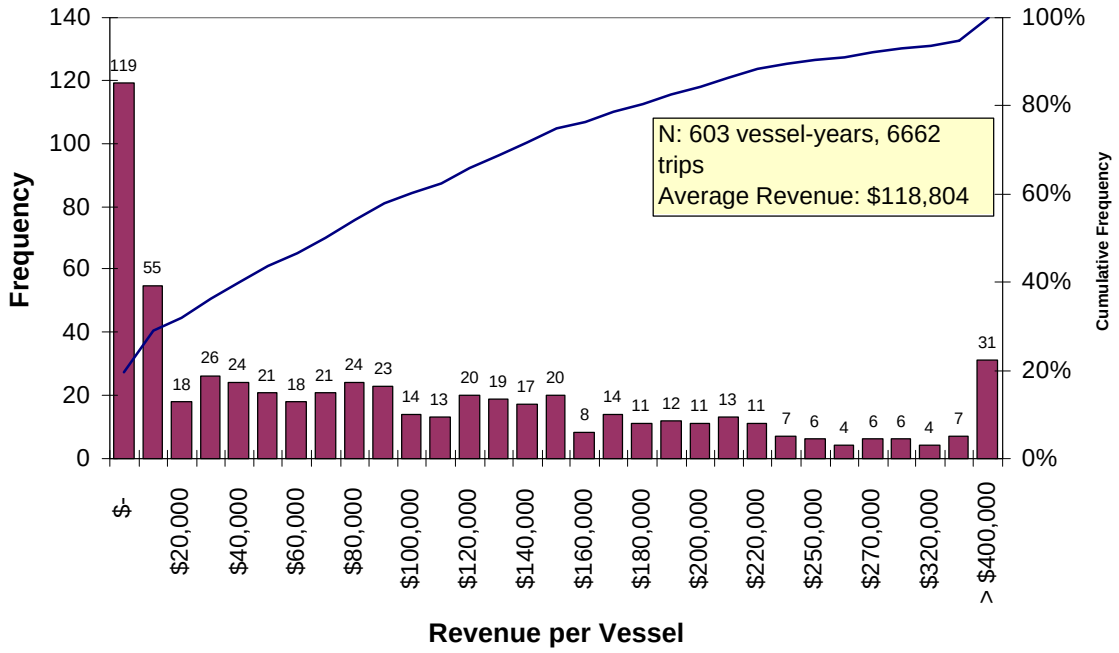
Figure 4.1.2 Cost per Pelagic Longline Trip: 1996-1998.



Swordfish and tunas typically account for approximately 85 percent by volume of the

landings by pelagic longline fishermen. Revenue was calculated by multiplying the average annual price for a species by the quantity of that species landed in a year by that vessel. The resulting distribution of revenue shown in Figure 4.1.3 indicates a large cluster of vessels at both the low and high ends of the revenue per vessel range. This suggests a heterogenous fleet with some vessels landing higher quality fish while others land lower valued fish.

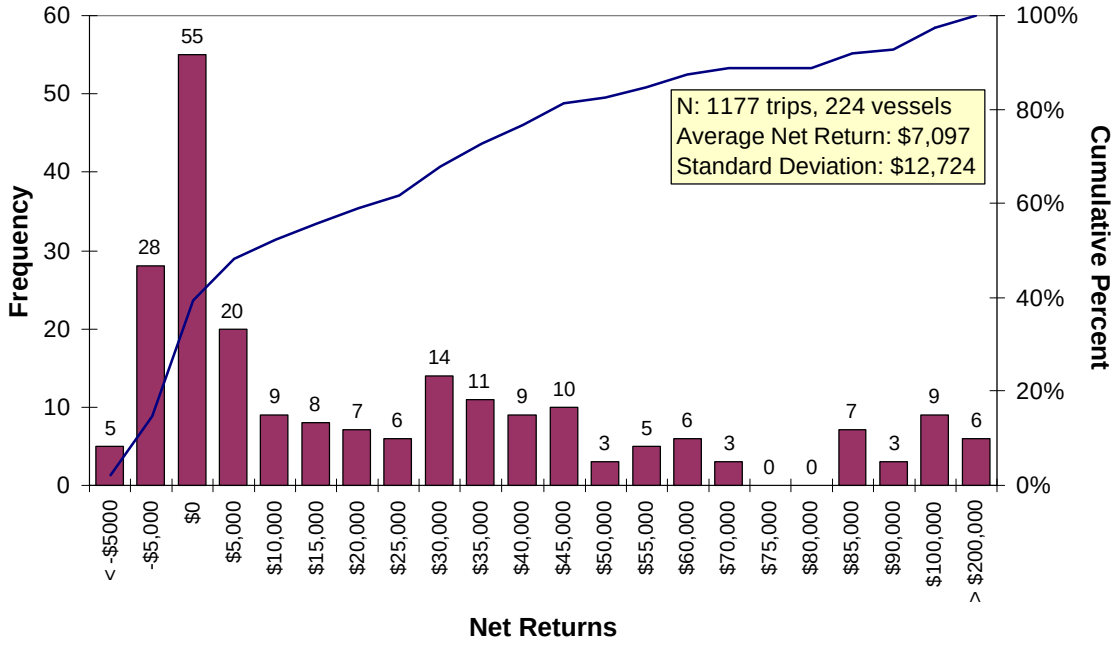
Figure 4.1.3 Total Revenue per Vessel: 1996-1997.



Revenue per vessel was calculated by multiplying the average annual price for a species by

the quantity of that species landed in a year by that vessel. The majority of vessels appear to have relatively low revenues, although many vessels earn considerable amounts. Total net returns can be calculated by subtracting the total cost from the total revenue. Ward and Hanson's results indicate that the majority of the fleet earns low to negative income (Figure 4.1.4). Fifty percent of the fleet are earning $10,000 or less and 20 percent of those are losing money (negative profit). This pattern is typical for fisheries operating within an open access management structure. The fishing businesses operating on the margin are typically the ones that are most likely affected by additional regulation and the first to exit the industry.

Figure 4.1.4 Total Net Returns by Vessel: 1996-1997.



4.1.5 Social Data

Western North Atlantic Longline Fishery: Sociological Survey

The following data are some of the highlights of a 1996 survey conducted at the Pelagic Longline Industry Bycatch Workshops (Hoey, 1996). Although the information presented here is not new, it is reviewed to highlight basic sociological data that may be useful when designing future surveys. Fifty-nine participants were surveyed of which 11 were vessel owners, 18 were

vessel owners/operators, 9 were hired captains, 12 crew members, 4 suppliers, and 5 were none of the above:

- In a comparison of current rankings of life as a commercial fisherman (on a scale of 0-10 where 0 is the worst possible life) versus rankings five years ago, 25 respondents indicated they were better off five years ago, 13 indicated they were better off now, and 10 indicated no change (48 respondents).

- In a comparison of current rankings of life as a commercial fisherman (on a scale of 0-10 where 0 is the worst possible life) versus predicted rankings five years from now, 25 indicated that conditions would get worse, 14 respondents indicated conditions would improve, and 9 indicated no change (48 respondents).

- Fifty-eight percent felt that their opinions had little or no impact on the current regulatory process (59 respondents).

- Eighty-two percent felt that federal regulations had an overall negative economic effect on the ability to fish commercially (57 respondents). Most responses cited income loss from requirements to discard dead fish and from quota closures.

- Seventy five percent felt that federal regulations had an overall negative effect on the quality of personal life (59 respondents). Most responses cited stress resulting from loss of income, longer trips, and longer periods of time away from home.

The survey results indicate that pelagic longline fishermen enjoy their work and their quality of life. Obviously, any regulatory framework dampens the independent nature of fishing and often dictates how, where, and when longlines can be set. Given the National Standard guidelines and the intent of the Magnuson-Stevens Act, there is no option but to set limits on fishing activities and the amount of fish caught. However, the survey data can be used to better predict the impacts of new regulations and assist in selecting those options that minimize negative effects on fishermen and their families.

Swordfish Permit Distribution

Limited access to the pelagic longline fishery for swordfish, sharks, and tunas is discussed in further detail in Section 8 of this report. However, when assessing the impacts of proposed regulations on pelagic longline fishermen, it is important to identify the communities in which they and their families reside. Since the distribution of limited access permits is relevant to the Atlantic pelagic longline fishery, a breakdown of those receiving directed or incidental swordfish permits is depicted here (Table 4.1.4). It is important to note that the addresses used in the permit distributions are the mailing addresses on file with NMFS, and not necessarily the home ports or communities in which the fishermen spend most of their time. The home port address for a given vessel may differ and may provide a varied indication of target areas for future socioeconomic studies. However, mailing address was selected here in order to identify concentrations of family

residences that may be impacted socially from additional management measures. Table 4.1.4 lists cities with eight or more permit holders qualifying for directed or incidental swordfish limited access permits as of December 30, 1999. Although a large fleet of longline vessels fish out of New England states, the towns with the greatest number of qualifying permit holders are found south of New York.

Table 4.1.4 **Swordfish Permit Distribution : Cities with Eight or More Permit Holders.** Based on the number of qualifying directed and incidental swordfish permit holders as of December 7, 1999 (449 total).

City	Number of Permits	State	Total Number of Permits in State	Percentage of State Permits in City
New Orleans	29	LA	51	56.9
Barnegat Light	27	NJ	77	35.1
Fort Pierce	14	FL	148	9.4
Cape May	10	NJ	77	13.0
Destin	10	FL	148	6.8
Pompano Beach	8	FL	148	5.4
St. Petersburg	8	FL	148	5.4
Harkers Island	8	NC	56	14.3
Wanchese	8	NC	56	14.3
Montauk	8	NY	46	17.4

4.1.6 Bycatch Issues and Data Associated with the Fishery

Fish are discarded from the pelagic longline fishery for a variety reasons. Swordfish, yellowfin tuna, and bigeye tuna may be discarded because they are undersized or unmarketable. Blue sharks, as well as some other finfish species, are discarded as a result of a limited market, rapid perishability, or low pricing levels. Large coastal sharks and swordfish are discarded from this gear when their respective quotas have been filled. Bluefin tuna may be discarded because the target catch requirements have not been met. All billfish and protected species including mammals, turtles, and birds are required to be discarded. Bycatch mortality of marlins, swordfish, and bluefin tuna may significantly reduce the ability of these populations to rebuild and remains an important management issue. NMFS is also concerned about serious injuries to turtles and marine mammals as a result of interactions with pelagic longline gear.

In response to concerns about bycatch in the pelagic longline fishery, NMFS has proposed

time/area closures in the Gulf of Mexico and South Atlantic Bight (64 FR 69982, December 15, 1999). The proposed rule would complement the time/area closure previously established in the HMS FMP to address discards of bluefin tuna (50 CFR 635.21 (c) (2)). The objectives of the proposed measures are: (1) maximize the reduction in finfish bycatch, (2) minimize the reduction in the target catch of swordfish and other target species, (3) ensure that the catch of other species remains unchanged or is also reduced, and (4) optimize survival of bycatch and incidental catch species. The preferred alternative consists of an area approximately 99,810 nm^2 in the Southeast Atlantic to be closed year-round and a 96,560 nm^2 area in the Gulf to be closed from March through September. Assuming that fishermen will re-distribute longline effort in open areas, the proposed closures result in the following bycatch reductions: swordfish discards, 22 percent; bluefin tuna discards, 49 percent, and sailfish discards, 10 percent. Under this alternative, blue marlin and white marlin discards increase by 5 percent and 6 percent, respectively, and the incidental catch of sea turtles increases by 8 percent. The analysis assumes a random pattern of re-distribution. If boats direct their effort towards the Caribbean, billfish discards may increase. If they avoid fishing in the Caribbean due to safety concerns (e.g., smaller vessels), billfish discards could be expected to benefit from a subsequent decrease in discards. The preferred alternative was selected to maximize the effectiveness of NMFS' management strategy relative to the stated objectives, while minimizing, to the extent practicable, economic and social impacts to vessels and communities within the closed areas. The draft Supplemental Environmental Impact Statement (SEIS) details the analyses on the different individual areas proposed for time/area closure. The consideration of the full range of effects of implementing time/area closures, as well as an analysis of other alternatives considered to address bycatch, is also described in the draft SEIS, and will be further discussed at upcoming public hearings and the February 2000 HMS Advisory Panel meeting.

Vessel Monitoring System Update

The rationale for the mandatory use of a vessel monitoring system (VMS) on all Atlantic pelagic longline fishing vessels that hold HMS permits and the implementation of this program is described in Section 3.8.2 of the HMS FMP. VMS is essential to the effective implementation and enforcement of time/area closures and provides increased communication and safety benefits to longline fishermen. NMFS has delayed the effective date of the VMS requirement until June 1, 2000, in order to allow pelagic longline fishermen sufficient time to comply with the regulation. Compliance involves review of the list of approved units, purchase and installation of hardware, and establishing communication with NMFS.

Observer Program

Observers recorded effort from 287 pelagic longline sets in 1998, representing approximately 2.9 percent of the total number of sets. Table 4.1.4 compares observer coverage in past years for this fleet. As required by NMFS' Biological Opinion, 5 percent of the pelagic longline trips were selected for observer coverage. In addition, ICCAT requires 5 percent observer coverage for all trips targeting yellowfin tuna and/or bigeye tuna. Due to logistical problems, it was not possible to place observers on all selected trips.

Table 4.1.4 Observer Coverage of the Pelagic Longline Fishery

Year	Number of Sets Recorded	Percentage of Total Number of Sets
1992	329	2.5
1993	815	6.0
1994	649	5.2
1995	696	5.2
1996	361	2.5
1997	448	3.1
1998	287	2.9

Marine Mammals

Marine mammal catch is estimated based on observed takes only. Fishermen report takes of mammals to NMFS in a marine mammal logbook. The Atlantic pelagic longline fishery is considered a Category I fishery under the Marine Mammal Protection Act (MMPA). In 1998, there were six observed takes of marine mammals by pelagic longlines. This number has been extrapolated out to an estimated 205 mammals fleet-wide. NMFS has not released any recent data on marine mammal catch from pelagic longline vessels, but a report is being prepared on the estimate of mortalities and serious injuries. This report was presented to the Scientific Review Group (SRG) in November 1999. The SRG reviewed the report, and NMFS is now evaluating the pelagic longline fishery in terms of the take reduction plan under Potential Biological Removal levels (short term goal) and Zero Mortality Rate Goal (long term goal). In addition to mammals released *dead* from fishing gear, uncommon in the pelagic longline fishery, NMFS must consider post-release mortality of mammals released *alive*.

The Atlantic SRG recognized the need to immediately apply serious injury "guidelines" to the Atlantic pelagic longline fishery. At the April 1999 meeting, NMFS presented a preliminary analysis of the serious injuries in this fishery and gave a rough estimate of the number of injuries. Based on these levels of takes, the SRG recommended maintaining the Category I listing for the Atlantic pelagic longline fishery in the proposed List of Fisheries for 2000. NMFS will summarize the serious injury determinations for the pelagic longline fishery in the upcoming proposed List of Fisheries.

Sea Turtles

The Atlantic pelagic longline fishery exceeded the authorized level of takes of loggerhead

turtles in 1999. As a result, NMFS has re-initiated consultation under Section 7 of the Endangered Species Act. Once NMFS develops reasonable and prudent alternatives to manage this fishery, fishermen may be faced with a regulatory proposal for gear modification or time/area closures in order to minimize the number of turtle takes. The area of concern is the Northeast Distant area where turtles are sometimes taken in high numbers from July through September.

Sea birds

Gannetts, gulls, and storm petrels are occasionally hooked by Atlantic pelagic longlines. These species and all other sea birds are protected under the Migratory Bird Treaty Act; endangered sea birds receive further protection under the Endangered Species Act. Sea bird populations are often slow to recover from excess mortality as a consequence of their low reproductive potential (one egg per year and late sexual maturation). According to NMFS observer data, from 1990-1997, 34 sea birds were hooked by pelagic longlines. Of those, 9 were released alive. The majority of longline interactions with sea birds occur as the gear is being set. The birds eat the bait and become hooked on the line; the line sinks and the birds are subsequently drowned.

The United States is developing a National Plan of Action in response to the FAO International Plan of Action to reduce incidental sea bird takes. Although pelagic longline interactions will be considered in the plan, NMFS has not identified a need to implement gear modifications aimed at reducing sea bird takes by Atlantic pelagic longlines. Takes of sea birds have been minimal in this fishery, most likely due to the setting of longlines at night and/or fishing in areas where birds are largely absent.

Finfish

Swordfish bycatch ranged from 7 percent to 45 percent of the total catch of swordfish per trip (by number) according to estimates based on reported observer and logbook data (Cramer and Adams, 1999). The most recent longline bycatch data are available from the 1999 U.S. National Report to ICCAT. Longline dead discards of swordfish in 1998 were estimated to be 442 mt ww or approximately 29,470 swordfish. Discard levels in 1998 mark a substantial reduction from those reported in 1997.

Longline bycatch of billfish in 1998 in many geographic areas declined from 1997 levels. Estimated billfish dead discards from commercial longlines were 52.4 mt for blue marlin, 32.8 mt for white marlin, and 27.0 mt for sailfish in 1998. In 1997, 138.1 mt blue marlin, 70.8 mt white marlin, and 57.7 mt sailfish were reported as dead discards.

Bluefin tuna dead discards from the pelagic longline fishery were 64 mt and 37.1 mt in 1998 and 1997 respectively. A June closure of an area off the New Jersey coast was implemented in 1999 to reduce dead discards of bluefin tuna in the pelagic longline fishery (54.8 mt in 1998 and 30.7 mt in 1997). This closure is expected to reduce dead discards by approximately 55 percent.

4.1.7 Safety Issues Associated with the Fishery

Like all offshore fisheries, pelagic longlining can be dangerous. Trips are extended, the work can be arduous, and the nature of setting and hauling the line may cause injuries due to hooking. Like all other HMS fisheries, longline fishermen are exposed to unpredictable weather. NMFS does not wish to exacerbate unsafe conditions through implementation of regulations. Therefore, NMFS considers safety factors when implementing management measures on pelagic longline fishermen. For example, all time/area closures are expected to be closed to fishing, not transiting, in order to allow fishermen to make a direct route to and from fishing grounds. VMS is also likely to improve safety concerns not only because of the Emergency Position Indicating Radiobeacon (EPIRB) abilities of the system, but because regulations can now be adjusted given the enforcement backup of the vessel monitoring system. For example, fishermen may not be required to offload swordfish by the time of the closure but rather can adjust their transit time to maximize safety, provided they do not fish after the season is closed. NMFS seeks comments from fishermen on any safety concerns they may have. Fishermen have pointed out that due to decreasing profit margins, they may fish with less crew or may not have the time or money to complete necessary maintenance tasks. NMFS cannot influence the market to improve profits to fishermen, but rather encourages fishermen to be responsible in fishing and maintenance activities.

4.2 Fishery Data: PURSE SEINE

4.2.1 Overview of History and Current Management

Domestic aspects of the Atlantic tunas purse seine fisheries are described in Section 2.2.3 of the HMS FMP. Social and economic aspects of the fisheries are described in Section 2.2.4.

Vessels using purse seine nets have participated in the U.S. fishery for bluefin tuna continuously since the 1950s, although a number of purse seine vessels did target and land bluefin tuna off the coast of Gloucester, MA as early as the 1930s. The limited entry system with non-transferable individual vessel quotas (IVQs) for purse seining was established in 1982, effectively excluding any new entrants to this category. Equal quotas are assigned to individual vessels by regulation; the IVQ system is possible given the small pool of ownership in this sector of the fishery. Currently, only five vessels comprise the bluefin tuna Purse Seine fleet and the quotas were made transferable among the five vessels in 1996.

The FMP and its final implementing regulations established percentage quota shares for bluefin tuna for each of the domestic fishing categories. For the Purse Seine category, NMFS adopted a cap on the amount of quota the category could be allocated. The HMS Advisory Panel (AP) met in Silver Spring, MD on June 10 and June 11, 1999, and discussed, among other issues, the Purse Seine category cap. The AP provided information and advice to NMFS on the issue of fairness in the context of allocation to the Purse Seine category.

On August 18, 1999 (64 FR 44885), NMFS published a proposed rule to remove the 250 mt cap on the Purse Seine category bluefin tuna allocation. NMFS held two public hearings on the proposed rule and the comment period closed on September 27, 1999. Numerous comments were received, both in favor of the proposed rule and against it. On October 27, 1999, NMFS filed a final rule with the Federal Register (64 FR 58793, November 1, 1999) removing the cap on the Purse Seine category.

4.2.2 Most Recent Catch and Landings Data

Table 4.2.1 shows purse seine landings of Atlantic HMS from 1995 through 1998. Purse Seine landings make up about 20 percent of the total annual U.S. landings of bluefin tuna (about 25% of total commercial landings), but account for only a small percentage, if any, of the landings of other HMS. In the 1980's and early 1990's, however, purse seine landings of yellowfin tuna were often over several hundred metric tons. Over 4,000 mt of yellowfin were recorded landed in 1985.

Table 4.2.1 **Domestic Landings for the Purse Seine Fishery: 1995-1998 (mt ww)**. NW Atlantic Fishing Area. Sources: 1999 U.S. National Report; additional data from the Northeast Region mandatory dealer program

Species	1995	1996	1997	1998
Bluefin Tuna	249.0	245.0	249.7	248.6
Yellowfin Tuna	0	6.8	0	0
Skipjack Tuna	0	0.7	0	0

4.2.3 U.S. vs. International Catch

Table 4.1.2 **Estimated International Purse Seine Landings in the Atlantic and Mediterranean: 1995-1998 (mt ww)**. Source: 1999 SCRS Report, U.S. National Report**.**

Species	1995	1996	1997	1998
Bluefin Tuna	20,912	22,606	20,666	12,904
Yellowfin Tuna	94,622	104,847	93,448	95,273
Skipjack Tuna	107,786	77,102	74,587	70,820
Bigeye Tuna	24,786	26,446	17,037	14,657
Total	**248,106**	**231,001**	**205,738**	**193,654**
US Total	**249**	**252.5**	**249.7**	**248.6**
US%	**0.10%**	**0.11%**	**0.12%**	**0.13%**

The U.S. purse seine fleet has historically accounted for a small percentage of total Atlantic landings. Over the past four years, the U.S. purse seine fishery has contributed less than 0.15 percent of the total purse seine landings reported to ICCAT.

At this year's ICCAT meeting, the Commission agreed to continue the prohibition on the use of Fish Aggregation Devices (FADs)in an area in the Gulf of Guinea. The closure (which became mandatory in 1999) was in response to concern over catches of juvenile and undersize tunas by purse seiners relying on FADs. While the closure is in place, data are being collected so that the SCRS can analyze the effects of "FAD-fishing" on the stocks.

4.2.4 Economic Data

There are no new economic studies or data available on the U.S. Atlantic tunas purse seine fishery. NMFS does not require logbooks and does not collect voluntary information from

this fishery.

4.2.5 Social Data

There are no new social studies or data available on the U.S. Atlantic tunas purse seine fishery. As a result of the limited entry system for purse seine vessels, NMFS can easily characterize the small number of participants (5 vessels and 3 owners) in the fishery.

4.2.6 Bycatch Issues and Data Associated with the Fishery

There is no new information on bycatch regarding the U.S. Atlantic tunas purse seine fishery. The Atlantic bluefin tuna Purse Seine category fishery is currently listed as a Category III fishery under the Marine Mammal Protection Act. This fishery was observed in 1996, with near-100 percent coverage. Six pilot whales, one humpback whale, and one minke whale were observed as encircled by the nets during the fishery. All were released alive or dove under the nets and escaped before being pursed. After a school of fish is located, a purse seine net is set by paying out the net in a circle around the school. This affords considerable control over what is encircled by the net and the net does not remain in the water for any considerable amount of time. Therefore, this gear-type is not likely to result in mortality or serious injury of marine mammals or sea turtles. As a result, it is NMFS' biological opinion that the continued operation of the purse seine fishery may adversely affect, but is not likely to jeopardize, the continued existence of any endangered or threatened species under NMFS jurisdiction.

4.2.7 Safety Issues Associated with the Fishery

There are no new safety issues associated with the U.S. Atlantic tunas purse seine fishery. Section 3.9 of the HMS FMP describes safety of human life at sea as it pertains to the fisheries for Atlantic HMS.

4.3 Fishery Data: COMMERCIAL HANDGEAR

Handgear are used for Atlantic HMS by fishermen on private vessels, charter vessels, and headboat vessels. Operations, frequency and duration of trips, and distance ventured offshore vary widely. An overview of the history of the HMS handgear fishery (commercial and recreational) can be found in Section 2.5.8 of the HMS FMP.

The proportion of domestic HMS landings harvested with handgear varies by species, with Atlantic tunas comprising the majority of commercial landings. Commercial handgear landings of all Atlantic HMS (other than sharks) in the United States are shown in Table 4.3.1. The fishery is most active during the summer and fall, although in the South Atlantic and Gulf of Mexico fishing occurs during the winter months. For bluefin tuna, commercial handgear landings accounted for approximately 60 percent of total U.S. bluefin tuna landings, and over 71% of commercial bluefin landings. The commercial handgear fishery for bluefin tuna occurs mainly in New England, with vessels targeting large medium and giant bluefin using rod and reel, handline, harpoon, and bandit gear. Beyond these general patterns, the availability of bluefin tuna at a specific location and time is highly dependent on environmental variables that fluctuate from year to year. Fishing usually takes place between 8 and 200 km from shore using bait including mackerel, whiting, mullet, ballyhoo, and squid.

The majority of U.S. commercial handgear (handline and bandit gear) fishing activities for BAYS tunas take place in the northwest Atlantic. Rod and reel gear use for these species is predominantly by recreational fishermen and is addressed in Section 4.4. In 1998, 4.3 percent of the total yellowfin catch, or 9.0 percent% of the commercial yellowfin catch, was attributable to commercial handgear. The majority of these landings occurred in the northwest Atlantic Ocean. Commercial handgear landings of skipjack tuna accounted for less than one percent of total skipjack landings, or about 2.1 percent of commercial skipjack landings. The percentages of albacore are similar to those for skipjack, and handgear landings of bigeye tuna accounted for less than one percent of total and commercial bigeye landings.

Swordfish are landed using harpoons and/or handlines. While commercial handgear is periodically used by New England fishermen, fishermen in the southeast may increase their handgear landings as the swordfish stock increases. Handgear landings of swordfish are shown in Table 4.3.1 and account for a very small percentage of total U.S. swordfish catch (less than 0.1%).

The HMS FMP established a limited access program for the commercial swordfish and shark fisheries (all gears), as well as for tunas (longline only). Fishermen who submitted an application by December 1, 1999, with documentation of a swordfish permit for use with harpoon gear or landings of swordfish with handgear as evidenced by logbook records, verifiable sales slips or receipts from registered dealers, or state landings records were eligible for a swordfish handgear permit. NMFS also issued handgear permits to those applicants who met the earned income requirement, i.e., those who had derived more than 50 percent of their earned income from commercial fishing through the harvest and first sale of fish or from charter/headboat fishing,

or those who had gross sales of fish greater than $20,000 harvested from their vessel, during one of the three calendar years preceding the application. Chapter 4 of the HMS FMP includes a complete description of the handgear permit for swordfish under the limited access system. As of January 18, 2000, 115 limited access swordfish handgear permits had been issued.

There are a significant number of sharks landed by fishermen using commercial handgear. However, the nature of the data collected and assessed for Atlantic sharks does not readily allow a breakdown into various commercial gear types. Anecdotal evidence suggests that many charter and headboat captains target sharks as an alternative when other species are unavailable. The Sutton and Ditton study on the Gulf charter/party boat industry (discussed further in Section 4.3.5) indicate that 65 percent of party boat operators targeted sharks at least once during the study period. Further information on Atlantic sharks catch and landings data is found in Section 4.5.

4.3.1 Overview of History and Current Management

A thorough description of the commercial handgear fisheries for Atlantic tunas can be found in Section 2.2.3 of the HMS FMP. Social and economic aspects of the domestic handgear fisheries are described in section 2.2.4 of the HMS FMP. For bluefin tuna, information regarding Prices and Markets, Costs and Expenses in the Commercial Fishery, Exports and Imports, Processing and Trade, Charter/Headboat Fishing, and Recreational Fishing can be found in Section 2.2.4.1. Section 2.2.4.2 details Commercial Fishing, Charter/Headboat Fishing, and Recreational Fishing for BAYS tunas.

The domestic swordfish fisheries are discussed in Section 2.3.3 of the HMS FMP. Social and economic aspects of the domestic handgear fisheries are described in Section 2.3.4.

The domestic shark fisheries are discussed in Section 2.4.3 of the HMS FMP. Directed fisheries for Atlantic sharks are conducted by vessels using bottom longline, gillnet, and rod and reel gear and discussed in Section 4.5 of this report. Social and economic aspects of the domestic handgear fisheries are described in Section 2.4.4 of the HMS FMP.

4.3.2 Most Recent Catch and Landings Data

Updated tables of landings for the commercial handgear fisheries by gear and by area for 1995-1998 are presented in Tables 4.3.1 and 4.3.2. As commercial shark landings are not recorded/disaggregated by gear type, no commercial handgear data is provided in this section. A complete discussion of Atlantic sharks is found in Section 4.5. In the HMS FMP, domestic landings of Atlantic bluefin tuna (1983 through 1997) and BAYS tunas (1995 through 1997) are presented in Section 2.2.3, and domestic catches (landings and discards) are presented in Section 2.3.3. As the majority of U.S. landings of yellowfin tuna are by rod and reel, a summary of the recently published total domestic recreational and commercial yellowfin landings (1981-1998) is presented in this section.

Table 4.3.1 Domestic Landings for the Commercial Handgear Fishery:1995-1998 (mt ww). Sources: National Report of the United States, 1999; Northeast Region Mandatory Dealer Program Data.

Species	Gear	1995	1996	1997	1998
Bluefin Tuna	Rod and Reel*	441.7	478.2	617.8	590.0
	Handline	65.5	32.5	17.4	29.2
	Harpoon	76.8	95.7	97.5	133.1
	TOTAL	**584.0**	**898.9**	**732.7**	**752.3**
Bigeye Tuna	Troll	16.5	4.1	3.9	4.0
	Handline	3.7	17.3	2.7	0.1
	TOTAL	**20.2**	**21.4**	**6.6**	**4.1**
Albacore Tuna	Troll	1.9	2.7	5.2	5.8
	Handline	2.6	3.8	4.8	0
	TOTAL	**4.5**	**6.5**	**10.0**	**5.8**
Yellowfin Tuna	Troll	355.7	371.0	237.6	177.5
	Handline	146.9	84.2	90.6	64.7
	TOTAL	**502.6**	**455.2**	**328.2**	**242.2**
Skipjack Tuna	Troll	2.3	0.9	7.9	0.4
	Handline	0.6	0.4	0.1	0
	Harpoon	**	0	0	0
	TOTAL	**2.9**	**1.3**	**8.0**	**0.4**
Swordfish	Troll	0	7.3	0.4	0.7
	Handline	0	0.1	1.3	0
	Harpoon	1.0	0.5	0.7	1.5
	TOTAL	**1.0**	**7.9**	**2.4**	**2.2**

* Rod and Reel catches and landings represent estimates of landings and dead discards based on statistical surveys of the U.S. commercial and recreational harvesting sectors.
** $\leq$ 0.05 mt

Table 4.3.2 **Domestic Landings for the Commercial Handgear Fishery: 1995-1998 (mt ww)**. Sources: National Report of the United States, 1999; Northeast Region Mandatory Dealer Program Data.

Species	Region	1995	1996	1997	1998
Bluefin Tuna	NW Atl	584.0	898.9	747.3	755.0
Bigeye Tuna	NW Atl	19.8	20.5	6.6	4.0
	GOM	0.4	0.9	0	0.1
Albacore Tuna	NW Atl	4.3	6.4	6.4	5.8
	GOM	0.1	0.1	0	0
	Carib	0.1	0	3.6	0
Yellowfin Tuna	NW Atl	473.3	408.2	252.3	177.5
	GOM	29.1	47.0	55.6	60.8
	Carib	0.2	0	20.3	3.9
Skipjack Tuna	NW Atl	0.4	1.2	0.7	0.4
	GOM	0.4	0.1	0	0
	Carib	2.1	0	7.3	0
Swordfish	NW Atl	1.0	7.9	2.4	2.2

Yellowfin Tuna Landings

In October 1999, NMFS published revised statistics on the level of U.S. recreational and commercial landings of Atlantic yellowfin tuna since 1981 (64 FR 58035, October 28, 1999). Preliminary statistics were published in March 1996 (61 FR 10319, March 13, 1996), and NMFS received considerable public comment. NMFS published these final statistics to inform the public of updated data on landings trends in the yellowfin tuna recreational and commercial fisheries. The preliminary data and related data collection issues have been discussed at meetings of the ICCAT Advisory Committee (IAC) in recent years. Comments received from both the general public and from the IAC resulted in extensive reexamination of the data by NMFS scientists to ensure the best available data on commercial and recreational yellowfin tuna landings for publication and subsequent revisions to the preliminary statistics. At the November 1998 IAC meeting, a copy of a draft report to be used as the basis for submitting revised estimates of yellowfin tuna landings to ICCAT was circulated to the IAC (Brown, 1998). After further refining the information, NMFS provided a draft scientific paper detailing yellowfin tuna data revisions to the IAC at its March 1999 meeting (Brown, 1999a).

The source of the yellowfin tuna data and revisions made to the historical database are described in a final paper that was submitted to the SCRS in 1999 (Brown, 1999b). A variety of

commercial landings databases were examined for the purpose of evaluating the possible need for revising U.S. landings of Atlantic bigeye, albacore, yellowfin, and skipjack tuna as reported to ICCAT. This SCRS paper updates, with appropriate revision and additions, a previous review of U.S. commercial landings of Atlantic yellowfin as presented in an earlier SCRS paper. In addition, various sources of recreational landing tallies and estimates are examined and landings values are presented.

In presenting these revised data to the SCRS, the United States formally revised historical landings statistics. These revised statistics have been submitted through the ICCAT reporting process, after incorporating the review comments received from both the IAC and the SCRS, and will be published in future reports of the SCRS. Because this review and revision of yellowfin tuna statistics included extensive research of all sources of yellowfin tuna data and a variety of estimation techniques, NMFS considers these historical data as the best data available at this time. NMFS, therefore, does not intend to consider further revisions to these data unless new, verifiable data become available.

NMFS is exploring new measures designed to improve the quality of yellowfin tuna commercial and recreational landings data. The HMS FMP established new permitting and reporting requirements for recreational vessels, including logbooks for Highly Migratory Species charter/headboats, if selected. Through efforts implemented under the Atlantic Coast Cooperative Statistics Program, NMFS is working with states and other fishery management authorities to ensure uniform, non-redundant, and consistent data collection systems. These and other efforts should contribute to improved quality of yellowfin tuna landings data in coming years.

Table 4.3.3 Yellowfin Tuna Commercial and Recreational Landings: 1981-1998 (mt ww).

Year	Commercial Landings	Recreational Landings
1981	1886	1274
1982	819	912
1983	358	2196
1984	1775	405
1985	6342	3394
1986	5102	4836
1987	5710	3952
1988	9166	1899
1989	6530	1930
1990	5121	545
1991	5495	1418
1992	5982	957
1993	4386	1898
1994	3775	4522
1995	4395	4157
1996	3788	4498
1997	4105	3569
1998	2693	2927

Handgear Trip Estimates

Table 4.3.4 displays the estimated number of rod and reel and handline trips targeting large pelagic species in 1998. The trips include commercial and recreational trips, and are not specific to any particular species. One can assume that most trips in MA, NH, and ME were targeting bluefin tuna, and that most of these trips were commercial, as approximately 90 percent of Atlantic tunas vessel permit holders in these states have commercial General category tuna permits. For the other states, the majority of the trips are recreational (in that fish are not sold), with the predominant targeted species consisting of yellowfin tuna and sharks.

Table 4.3.4 Estimated Total Trips Using Rod and Reel or Handgear Targeting Large Pelagic Species from June 1 Through November 1, 1998. Source: LPS telephone and dockside interviews. Estimates are preliminary.

State/Area	Private Vessel Trips	Charter Trips	Total
VA	3,372	658	4,030
MD/DE	7,879	2,994	10,873
NJ	13,720	2,485	16,205
NY	9,501	2,994	12,495
CT/RI	3,946	1,077	5,023
MA	12,456	661	13,117
NH/ME	7,859	500	8,359
Total	**58,733**	**11,369**	**70,102**

4.3.3 U.S. vs. International Catch

SCRS data do not lend themselves to organize international landings into a commercial handgear category. While some countries report rod and reel landings, these numbers may include both commercial and recreational landings. Reported 1998 international catches of all Atlantic HMS can be found in Table 4.1.

4.3.4 Economic Data

Information on the economics of the handgear fisheries for Atlantic HMS that has become available since the publication of the HMS FMP is described below. Additional description of the economics of the Atlantic HMS fisheries, including those using handgear, are presented in Section 2.2.4 of the HMS FMP. Export and import data, including those for tuna caught with commercial handgear, are updated in Section 6 of this report. Since bluefin tuna are primarily targeted with commercial handgear, economic studies involving bluefin tuna are discussed here.

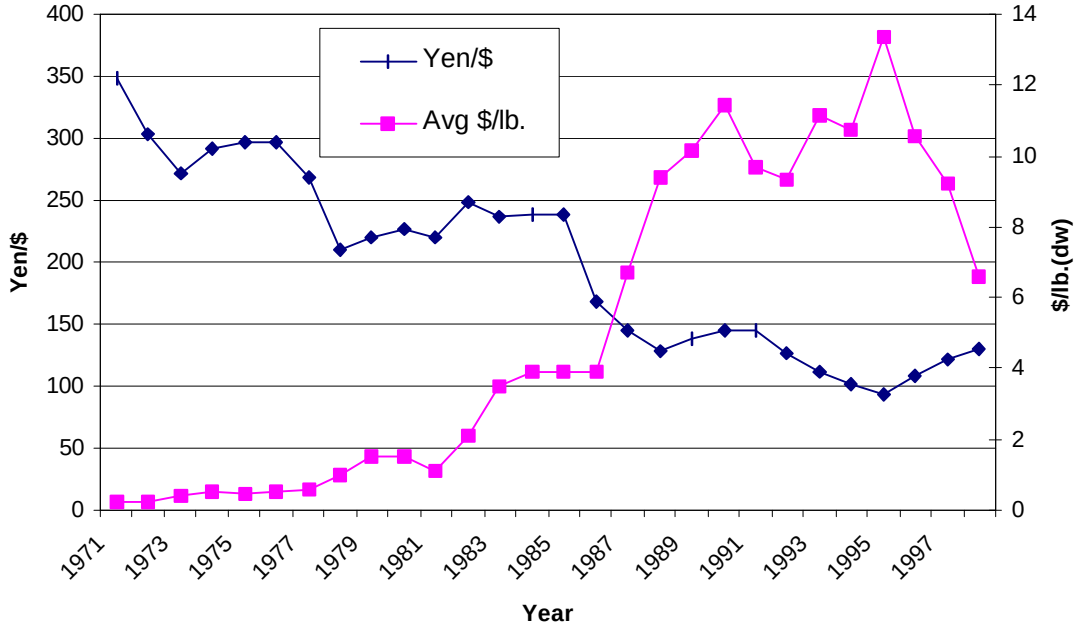
In 1999, researchers at the University of Rhode Island issued a final report on a project entitled, "Assessment of Atlantic Bluefin Tuna Markets: The Economic Implications for Management Plans" (Carroll *et al*, 1999). The objectives of the project were: 1) to evaluate the influence of factors such as quantity supplied, time of harvest, and quality characteristics on the price of U.S. Atlantic bluefin tuna sold on the Japanese wholesale market; 2) to determine the relationship between prices in Japan and ex-vessel prices received by U.S. fishermen, and 3) to determine how different fishery management options influence gross revenues received by U.S. fishermen. The final report concluded that regulations should be implemented so as to avoid

capture seasons that are condensed into sporadic intervals. The researchers recommend that consumer preferences should be considered for the efficient exploitation and trade of bluefin tuna in order to help increase revenues for the industry and to eliminate economic inefficiencies generated by public management. Specifically, the report suggests a more dispersed allocation of harvest planned in conjunction with periods of the year when fish seem to possess consumer-favored characteristics, such as high fat content.

In the Spring of 1999, NMFS contracted with researchers at the University of Massachusetts to perform a study on the use of spotter aircraft in the Atlantic bluefin tuna fishery. The main goals of the study were as follows: Quantify the extent of spotter plane use in the bluefin tuna fishery and collect information about the pilots, plane owners, and vessel operators involved; gather economic data related to the use of spotter planes in the bluefin tuna fishery; investigate the effect spotter planes have on catch rates and season length in the bluefin tuna fishery, and; investigate the safety issues related to the use of spotter planes in the bluefin tuna fishery. Copies of the final report can be obtained from the HMS Management Division at the Northeast Regional Office of NMFS in Gloucester, MA.

Recent price and market information is included in section 2.2.4 of the HMS FMP. The predominant commercial fishery for bluefin tuna in the United States is the handgear fishery in New England, and prices for bluefin tuna can be greatly influenced by many factors, including the Japanese Yen/U.S. Dollar (¥/$) exchange rate. Figure 4.3.1 shows the average ¥/$ exchange rate, plotted with average ex-vessel bluefin tuna prices, from 1971 to 1998. The average monthly ¥/$ exchange rate for January through October 1999 was approximately 116, down from 131 in 1998. Ex-vessel prices have not yet been compiled for 1998, but reports from fishermen and dealers indicate that ex-vessel prices were higher than in 1998 mostly due to the devaluation of the dollar in relation to the yen. The pace of landings in the General category in 1999 was slower than in recent years (with the exception of October), which may have also contributed to better ex-vessel prices, as market gluts from too many U.S. fish being sold at once did not occur or were more infrequent. Reports from fishery participants indicate that the lower catch rates may have been attributable to warmer than average water temperatures in the New England area.

Figure 4.3.1 Average Annual Yen/$ Exchange Rate and Average U.S. Bluefin Tuna Ex-vessel $/lb (dw): 1971-1998.



4.3.5 Social Data

A recent study (Sutton and Ditton, 1999) details key social and economic characteristics of the for-hire fishery in the offshore waters of Alabama, Mississippi, Louisiana, and Texas. The charter and party boat industry has been historically difficult to classify within a fishery management framework. They are essentially commercial fishermen, earning their livelihood from fishing activity, yet they must comply with recreational limits. Sutton and Ditton's study results apply primarily to fishermen governed under the Gulf of Mexico Fishery Management Council, but there is interaction with several stocks classified as Highly Migratory Species. In addition, general conclusions about the charter and party boat fisheries apply to HMS management, notably the importance of industry participation in any further fishery management in the Gulf. There has been some difficulty in assessing the socio-economic dynamics of the for-hire fisheries in the past since they tend to operate on a multi-species basis.

Sutton and Ditton provide a wide range of social and economic indicators to assess the status of the fishery and contrast the results with a similar study conducted in 1989 (Ditton *et al.*) for longitudinal perspective. Key indices that apply to Atlantic tunas, swordfish, sharks, and billfish are:

Species Dependence

- Fifty-five percent of charter boat operators targeted tuna at least once between March 1, 1997 and February 28, 1998.
- Five percent of total charter boat effort during that time period was directed towards tuna.
- Sixty-five percent of party boat operators targeted shark and 55 percent targeted tuna at least once between March 1, 1997 and February 28, 1998.
- Five percent of total party boat effort during that time period was directed towards sharks.
- Only 35 percent of charter and 10 percent of party boats targeted billfish at least once between March 1, 1997 and February 28, 1998.

Financial Operations and Economic Impact

- Estimated average annual gross revenue for charter boats was $68,934 (most operations do not appear to be highly profitable).
- Estimated income and employment generated by the charter boat industry was: Alabama - $5.6 million (270 jobs); Mississippi - $2.1 million (211 jobs); Louisiana - $1.8 million (118 jobs); and Texas - $6.1 million (385 jobs).
- Estimated average annual gross revenue for party boats was $137,308.
- Estimated income and employment generated by the party boat industry was: Alabama - $348,979 (16 jobs); and Texas - $1.7 million (77 jobs).

Opinions on Fisheries Management

- Eighty-five percent of charter and 100 percent of party boat operators cited “fishing regulations” as an important problem facing the industry (red snapper regulations were the most contentious).

Major Changes Since 1987

- The number of charter boats in the study area increased from 210 in 1987 to 430 in 1997.
- The number of party boats in the study area decreased from 26 in 1987 to 23 in 1997.
- The number of passenger-trips taken on both charter and party boats has increased three-fold since 1987 (436,706 total estimated trips).
- There has been an observed trend of increased boat length, horsepower, maximum capacity, and reliance on offshore species since 1987.

Since publication of the HMS FMP, NMFS has received comment from the families of General category bluefin fishermen that restricted-fishing days allow for the scheduling of family activities during the bluefin season, and that waiving restricted fishing days is disruptive as fishermen feel compelled to fish on every open fishing day. NMFS will consider these comments and other information from fishery participants when planning future General category effort control schedules and will discuss these issues with the HMS AP.

4.3.6 Bycatch Issues and Data Associated with the Fishery

As compared with other commercial gear types, commercial handgear produces relatively lower levels of bycatch. However, bycatch in the yellowfin tuna commercial handgear fishery is unmonitored in those areas where commercial activities occur after the Large Pelagic Survey

(LPS) sampling season. Rod and reel discards of HMS as assessed from LPS data are discussed in the Recreational Section (4.4.6) as are new efforts in documenting catch and release survival rates. At this time, however, there is little information regarding important interactions and new data relating to commercial handgear bycatch. Anecdotal reports suggest that there may be an issue of small yellowfin tuna and bigeye tuna discards, but there is no supporting documentation at this point. Some regulatory discards occur because fishermen must comply with minimum size restrictions.

4.3.7 Safety Issues Associated with the Fishery

Section 3.9 of the HMS FMP describes safety of human life at sea as it pertains to the fisheries for Atlantic HMS. Additional safety information regarding the commercial handgear fisheries for Atlantic HMS is presented below.

In September 1999, three vessels participating in the Atlantic bluefin tuna General category capsized off Chatham, Massachusetts. Two of the vessels capsized due to weight while attempting to boat commercial-sized bluefin tuna (measuring 73 inches or greater and weighing several hundred pounds). The third vessel capsized while under tow by another vessel. Although the United States Coast Guard (USCG) conducts routine vessel safety inspections at sea on a variety of vessels throughout the year, the USCG concentrated patrol activities on bluefin boats and followed the fleet south of Cape Cod during the busy fall season. Boarding officers indicate that although the majority of General category vessels have the necessary safety equipment, many part-time fishermen operating smaller vessels do not.

Currently, NMFS does not require proof of proper safety equipment as a condition to obtain an Atlantic tunas permit. Instead, NMFS informs permit applicants that commercial vessels are subject to the Fishing Vessel Safety Act of 1988 and advises them to contact their local USCG office for further information. The USCG District Boston office reports receiving 50 to 75 calls a week during the peak fishing season; officers speak with callers to answer all vessel questions including those pertaining to equipment.

Since NMFS regulations do not require USCG inspection or safety equipment in order to obtain a General category permit, NMFS cannot be certain that all participants in the commercial bluefin fishery are adequately prepared for the conditions they may encounter. NMFS is concerned about the safety of all vessels participating in the General category and is working with the USCG to improve communication of vessel safety requirements to General category vessel operators.

It is unlawful for Atlantic tunas vessels to engage in fishing unless the vessel travels to and from the area where it will be fishing under its own power and the person operating that vessel brings any bluefin tuna under control (secured to the catching vessel or on board) with no assistance from another vessel, except when shown by the operator that the safety of the vessel or its crew was jeopardized or other circumstances existed that were beyond the control of the operator. NMFS Enforcement and USCG boarding officers have recently encountered vessels

participating in the bluefin tuna fishery that are unable to transit to and from the fishing grounds due to their limited fuel capacity. Occasionally these smaller vessels will work in cooperation with a larger documented vessel to catch a bluefin; others have been observed to leave lifesaving equipment at the dock to make room for extra fuel, bait, and staples. NMFS is concerned that use of such inadequately-equipped vessels jeopardizes crew in that the vessel may not be able to safely return to shore without assistance of the larger vessel due to insufficient fuel or to adverse weather conditions.

If a vessel is boarded at sea and found to be lacking major survival equipment, the USCG may terminate the trips and escort the vessels back to the dock. In 1999, the USCG focused boardings on small vessels, especially those owned by "part-time" commercial bluefin fishermen, and terminated about ten trips due to the lack of safety equipment on board.

NMFS has received comments from some General category participants that effort controls, particularly restricted-fishing days (RFDs), allow fishermen to rest and to make needed vessel repairs, and therefore improve safety. On the other hand, there is a perception by many General category participants that every open day must be fished. The issue of effort controls alleviating fatigue problems was discussed in the FMP, but vessel repairs were not. NMFS also continues to receive comments, as discussed in the FMP, that indicate that RFDs may encourage fishermen to fish in conditions which they generally would avoid on open days, and that a season without RFDs would allow fishermen to choose their own schedule of fishing days, thus alleviating derby conditions and safety concerns.

NMFS will consider all safety comments and information from the USCG and NMFS Enforcement when planning future General category effort control schedules and will discuss these issues in future meetings with the AP.

4.4 Fishery Data: RECREATIONAL HANDGEAR

The HMS Handgear (rod and reel, handline, and harpoon) fishery includes both commercial and recreational fishermen and is described in Section 2.5.8 of the HMS FMP. This section will describe the recreational portion of the handgear fishery, primarily rod and reel fishing. Commercial handgear fisheries for HMS are discussed separately in Section 4.3 of this report.

4.4.1 Overview of History and Current Management

Atlantic tunas, swordfish, and sharks are managed under the HMS FMP, while Atlantic billfish are managed separately under the Billfish Amendment. The history of Atlantic billfish management is reviewed in Section 1.1.1 of the Billfish Amendment. Summaries of the domestic aspects of the Atlantic tuna fishery, the Atlantic swordfish fishery, and the Atlantic shark fishery are found in Sections 2.2.3, 2.3.3, and 2.4.3, respectively, of the HMS FMP.

Atlantic tunas, sharks, and billfish are all targeted by recreational fishermen using rod and reel gear. Atlantic swordfish are also targeted and, although this fishery had declined dramatically over the past twenty years, recent anecdotal reports suggest that a recreational swordfish fishery may be growing in the Mid-Atlantic Bight and off the East Coast of Florida. Recreational fishing for Atlantic HMS is managed primarily through the use of minimum sizes and bag limits. Recreational tuna fishing regulations are the most complex and include a combination of minimum sizes, bag limits, limited seasons based quota allotment for bluefin tuna, and reporting requirements depending on the particular species and vessel type. Atlantic tunas are the only HMS species group that require a permit for recreational fishing at this time. Bluefin tuna are the only HMS species managed under a recreational quota for which the fishing season closes after the quota has been met. While Atlantic marlin have associated landing caps (a maximum amount of fish that can be landed), the overall strategy for management of recreational billfish fisheries is based on size limits. The recreational fishery for swordfish is also managed through a minimum size requirement. The recreational shark fishery is managed through bag limits in conjunction with minimum size requirements. Additionally, the possession of several species of sharks is prohibited.

Through restrictions on the recreational fishery, the United States intends to achieve at least a 25 percent reduction in billfish landings by the end of the 1999 fishing year as required by ICCAT. U.S. landings of white marlin were reduced 20 percent from 1996 levels (63 FR 14030, March 23, 1998) through an increase in the minimum size to 168 cm (66 inches) for the 1998 fishing season. Blue marlin minimum size requirements were increased as well to a limit of 244 cm (96 inches). However, 1998 reported landings of blue marlin exceed those reported in 1997. On September 29, 1998 (63 FR 51859), the minimum size for blue marlin was increased once again to 251 cm (99 inches). The Billfish Amendment maintained these size requirements.

4.4.2 Most Recent Catch and Landings Data

The recreational landings databases for HMS consist of data obtained through surveys including the Marine Recreational Fishery Statistics Survey (MRFSS), Large Pelagic Survey (LPS), Southeast Headboat survey (HBS), Texas Headboat survey, and the Recreational Billfish Survey tournament data (RBS). Descriptions of these surveys, the geographic areas they include, and their limitations, are discussed in both the HMS FMP and the Billfish Amendment in Sections 2.6.2 and 2.3.2, respectively.

Reported domestic landings of Atlantic bluefin tuna (1983 through 1998) and BAYS tuna (1995 through 1997) are presented in Section 2.2.3 of the HMS FMP. As landings figures for 1997 and 1998 were preliminary, updated tables of landings for these recreational rod and reel fisheries in 1995-1998 are presented below with updates of other HMS species. Recreational landings of swordfish are monitored by the LPS and the MRFSS. However, because swordfish landings are considered rare events, it is difficult to extrapolate the total recreational landings from dockside intercepts.

Table 4.4.1 Updated Domestic Landings for the Atlantic Tunas, Swordfish and Billfish Recreational Rod and Reel Fishery: 1995-1998 (mt ww)*. Sources: 1999 National Report, Large Pelagic Survey, SEFSC Recreational Billfish Survey.

Species	Region	1995	1996	1997	1998
Bluefin tuna**	NW Atlantic	402	362	299	184
Bigeye tuna	NW Atlantic	11.8	108.2	333.5	228.0
	GOM	0	0	0	0
Albacore	NW Atlantic	19.1	277.8	269.5	601.1
	GOM	0	61.7	65.2	0
	Total	19.1	339.5	334.7	601.1
Yellowfin tuna	NW Atlantic	4125.4	4484.8	3560.9	2845.7
	GOM	31.7	13.2	7.7	80.9
	Total	4157.1	4498	3569	2927
Skipjack tuna	NW Atlantic	20.5	48.1	42.0	49.5
	GOM	0	36.4	21.7	37.0
	Total	20.5	84.5	63.7	86.5
Blue marlin***	NW Atlantic	23.0	17.0	25.0	34.1
	GOM	14.0	8.3	11.5	4.5
	Caribbean	6.0	9.6	8.6	10.6
	Total	43.0	34.9	45.1	49.2
White marlin***	NW Atlantic	8.0	2.7	0.9	2.4
	GOM	1.0	0.6	0.9	0.2
	Caribbean	0.0	0.0	0.0	0.02
	Total	9.0	3.3	1.8	2.6
Sailfish***	NW Atlantic	9.0	0.2	0	0.1
	GOM	1.0	0.8	0.4	1.0
	Caribbean	0.0	0.2	0.2	0.05
	Total	10.0	1.2	0.6	1.15

* Rod and reel catches and landings for Atlantic tunas represent estimates of landings and dead discards based on statistical surveys of the U.S. recreational harvesting sector.

**Rod and Reel catch estimates for bluefin tuna in the U.S. National Report to ICCAT include both recreational and commercial landings. Rod and reel catch of bluefin less than 73" curved fork length (CFL) are recreational, and rod and reel catch of bluefin 73 inches CFL or greater are commercial. Rod and reel catch of bluefin > 73" CFL also includes a few metric tons of "trophy" bluefin (recreational bluefin 73").
***Blue marlin, white marlin, and sailfish landings are estimated based on the SEFSC Recreational Billfish Survey and the Large Pelagic Survey.

Table 4.4.2 **Final Estimates of Total Recreational Harvest of Large Coastal Sharks: 1995-1998 (numbers of fish in thousands)**. Source: Modified from 1998 Report of the Shark Evaluation Workshop (changes from previously reported estimates are noted)*

Species Group	1995	1996	1997	1998
LCS	176.3 (-7.1)	188.5 (4)	165.1 (3.2)	160.4
Pelagic	32.8	20.8	8.4	11.6
SCS	135.1	112.7	97.0	77.9

*For an explanation of the derivation of these estimates, see the 1999 Shark Evaluation Annual Update.

Table 4.4.3 1998 Recreational Landings of Atlantic Sharks by Number.

Large Coastal Sharks	Recreational Landings
Bignose	none reported
Blacktip	76,522
Bull	802
Dusky	4,277
Hammerhead	384
Hammerhead, Great	441
Hammerhead, Scalloped	1,101
Hammerhead, Smooth	370
Lemon	1,992
Night	none reported
Nurse	2,690
Reef	none reported
Sand Tiger	none reported
Sandbar	33,245
Silky	5,039
Spinner	7,119
Tiger	1,302
Large Coastal	16,505
Unclassified	none reported
Unclassified Fins	none reported
Total:	151,791

Pelagic Sharks	Recreational Landings
Bigeye thresher	none reported
Blue	6,003
Shortfin Mako	5,581
Longfin Mako	none reported
Mako	none reported
Oceanic Whitetip	none reported
Porbeagle	none reported
Thresher	36
Pelagic	none reported
Unclassified	none reported
Total:	11,620

Small coastal sharks	Recreational Landings
Atlantic Angel	107
Atlantic Sharpnose	42,048
Blacknose	9,578
Bonnethead	26,191
Finetooth	none reported
Unclassified	none reported
Total:	77,924

Rod and Reel Billfish Landings

Two papers submitted to the SCRS in October of 1999 report on trends in billfish landings in the United States. A preliminary evaluation of U.S. billfish landings in 1998 relative to 1996 was performed by the SEFSC to compare respective U.S. rod and reel catches and fishing success. This evaluation compares results from the Recreational Billfish Survey (RBS) for 1998 with the 1996 survey results. It appears that the minimum sizes implemented in 1998 may have contributed to decreases in numbers of blue marlin and white marlin boated, percentage of fish boated, and the abundance adjusted boating rates. The reductions in numbers of fish boated and in boated rates were in the order of 17-25 percent for blue marlin and at least 25 percent for white marlin when comparing all events between years or matched events in both years.

The other paper addressing U.S. billfish landings explores the possible integration of the U.S. Marine Recreational Fisheries Statistical Survey (MRFSS) catch estimates and the U.S. RBS. The resulting model attempts to estimate total U.S. recreational marlin landings by adjusting for the bias in the relatively precise annual RBS estimates. The bias correction was based on regressions of relatively unbiased, but highly imprecise, MRFFS estimates on the RBS estimates. The resulting models were used to predict the U.S. recreational landings of Atlantic blue marlin and white marlin for 1981-1997. These preliminary estimates will continue to be evaluated and presented at the Data Preparatory Session of the ICCAT Billfish Workshop scheduled for the summer of 2000. Additional research will be conducted and reported to the ICCAT Billfish Workshop during the summer of 2000.

4.4.3 U.S. vs. International Catch

Important fisheries including directed recreational fisheries of the United States, Venezuela, Bahamas, Brazil, and many other countries and entities in the Caribbean Sea and off of the west coast of Africa are responsible for significant HMS landings. Directed recreational fisheries for sailfish occur in the west Atlantic from the United States, Venezuela, Bahamas, Brazil, Dominican Republic, Mexico, and other countries in the Caribbean Sea. However, of these countries, the United States is the only country that reports recreational landings to ICCAT. Therefore, a comparison of the percentage of U.S. landings relative to recreational fisheries in other countries is not feasible. In addition, total landings data are incomplete for 1997 and 1998 because many countries that reported landings in 1996 failed to report their 1997 and 1998 landings. However, new landings data are becoming available for historically traditional fisheries, as well as some artisanal fisheries.

As part of a 1997 SCRS survey, 12 ICCAT member countries as well as Chinese Taipei and Senegal provided information on the existence of, and level of data collection for, recreational and artisanal fisheries. Survey results indicated that Brazil, Canada, France, Italy, Morocco, UK, Bermuda, and the United States have recreational fisheries in the ICCAT area of concern. Levels of data collection varied widely from country to country, making any comparison of catch levels difficult and potentially inaccurate. The wide range of recreational catch across nations and species does warrant further exploration of potential data sources and the feasibility of increased monitoring.

At the 1999 ICCAT meeting in Rio, the Commission adopted a resolution to improve the quantity and quality of recreational data collection. Recreational fisheries are to be discussed and assessed in each country's National Report beginning in the year 2000. In addition, the SCRS was called upon to examine the impact of recreational fishing on tuna and tuna-like species.

4.4.4 Economic Data

A summary of the social and economic aspects of the recreational Atlantic tunas, swordfish, and shark fisheries is provided in Sections 2.2.4, 2.3.4, and 2.4.4 of the HMS FMP. A

description of available economic data on the billfish recreational fishery is in Section 2.1.4.1 of the Billfish Amendment.

A team of NMFS economists conducted a survey in 1994 of anglers in New England and the Mid-Atlantic. The data collected were used to estimate expenditures and economic value of the various groups of recreational fisheries in this area. One category of fishing, called "Big Game" consisted primarily of HMS, including sharks, billfish, and tunas. Non-HMS species in the category included wahoo, dolphin, tarpon, and cobia. The results of the study were recently published in a series of NOAA Technical Memoranda (Hicks *et al*, 1999; Thunberg *et al*, 1999; and Steinback *et al*, 1999). Although these regions are not an exhaustive picture of the entire HMS recreational fishery, the results provide considerable insight into the absolute and relative values of the recreational fisheries for HMS.

Using historic catch rate data in combination with actual choices made by recreational anglers (where and how to fish), a site choice model was estimated for recreational demand for saltwater angling. This model can be used to predict how anglers might react to changes in expected catch rates as well as various regulations.

Overall average willingness to pay (WTP) for a one-day fishing trip ranged from a low of less than a dollar in New Hampshire to a high of $42 in Virginia. Aggregate WTP (average WTP times the number of trips) ranged from $18 million in New Hampshire to nearly $1 billion in Virginia. Using model results, it was possible to estimate the WTP for a one fish increase in the expected catch rate across all sites in the choice set. The highest average value was attributed to big game fish, ranging from $5 to $7 per trip (about $5.40 on average), in addition to the value of the trip. The marginal value of an increase in catch per trip was highest for big game fish, and lowest for bottom fish.

Survey results indicated that boat fees were responsible for the greatest percentage of expenditures. Roughly 70 percent and 53 percent of total expenditures went for private/rental boats and charter/party boats, respectively. Travel expenses were the smallest portion of expenditures, although travel costs for those fishing on party/charter vessels were about twice as high as those for anglers on private/rental boats ($28 vs. $16).

While these results are useful in considering the economic value of HMS recreational fisheries, specific surveys focusing on HMS are preferable in order to consider the particular nature of these fisheries. NMFS will continue to pursue options for funding economic surveys of the recreational HMS fisheries..

4.4.5 Social Data

The NOAA Technical Memoranda cited above (Hicks *et al*, 1999; Thunberg *et al*, 1999; and Steinback *et al*, 1999) included an analysis of survey questions on "Big Game" recreational anglers' attitudes towards fishery regulations. The results appear to indicate that anglers in the northeast are conservation-minded, as most support four basic types of recreational measures:

minimum sizes, bag limits, seasons and area closures. Minimum sizes were deemed most popular (over 90 percent of anglers approved), while area restrictions were the least popular management alternative (two-thirds of anglers approved).

In August 1999, a thesis was submitted to the College of Agriculture and Life Sciences of Texas A&M University that analyzed the management preferences of members of The Billfish Foundation (TBF) who responded to a mail survey (Gillis, 1999). The survey was sent to a random sample of 435 TBF members (approximately 11 percent of membership residing in the United States). A total of 229 surveys were completed and returned at a 57 percent response rate (excluding 24 surveys that were undeliverable). The study focused on billfish angler preferences for potential management measures necessary to achieve a 25 percent reduction in landings of Atlantic blue and white marlin. The management measures were those considered by NMFS in the Draft Amendment One to the Billfish FMP. Respondents evaluated sixteen potential management regimes defined by two levels of the six different management measures NMFS was considering as options.

Respondents' evaluation choices were most influenced by the management measures concerning "Tournaments" and "Hook Restrictions", which accounted for an average of 39 percent and 21 percent, respectively, of TBF member evaluation choices. TBF members were found to prefer "mandatory no-kill tournaments" over "no new tournament specific regulations" and "limiting rigs and lures to a single hook only" over "no restrictions on the number of hooks used". In general, TBF members appeared to prefer the most restrictive management regime that could be constructed from the different levels of the six management measures.

The results of this study concern the preferences of TBF members only and therefore it can not be concluded that the results are indicative of the preferences of billfish anglers overall. As active members of one or more conservation groups, it would be expected that their preferences for management measures would differ from other billfish anglers who may not be involved in related conservation efforts. However, the study concludes that survey analysis can be a useful tool to define management regimes that achieve biological objectives while maximizing constituent satisfaction.

An additional report, "A Cross-sectional Study and Longitudinal Perspective on the Social and Economic Characteristics of the Charter and Party Boat Fishing Industry of Alabama Mississippi Louisiana, and Texas", prepared for NMFS through a research contract with the Texas A&M University Research Foundation was submitted in August of 1999. The purpose of the study was to provide fisheries managers with both a current and historical perspective on the for-hire fishery in offshore waters in Alabama, Mississippi, Louisiana, and Texas by replicating a previous study of charter and party boat operators in the central and western Gulf of Mexico (Ditton et al., 1989). The charter headboat fishery is a commercial sector and is discussed in more detail in Section 4.3. Additional new social information is also discussed in Section 5.2.

4.4.6 Bycatch Issues and Data Associated with the Fishery

Bycatch in the recreational rod and reel fishery is difficult to quantify because many fishermen value the experience of fishing and may not be targeting a particular pelagic species. Based on results from a March 1997 to February 1998 NMFS-conducted socioeconomic survey of recreational fisherman from North Carolina through Louisiana, 60 percent of fishermen did not have a target species when they fished (see Section 5.2 for more information on this study). Recreational "marlin" or "tuna" trips may yield dolphin, tunas, wahoo, and other species, both undersized and legally sized. Bluefin trips may yield undersized bluefin or a seasonal closure may prevent landing of a bluefin tuna above the minimum size. In some cases, therefore, rod and reel catch may be discarded. 1998 bluefin tuna rod and reel discards were estimated at less than 3 mt (49 fish), a decrease from the 15 mt of dead discards reported in 1997.

The Billfish Amendment established a catch-and-release fishery management program for the recreational Atlantic billfish fishery. As a result of this program, all Atlantic billfish that are released alive, regardless of size, are not considered bycatch. NMFS believes that establishing a catch and release fishery in this situation will further solidify the existing catch-and-release ethic of recreational billfish fishermen, thereby increasing release rates of billfish caught in this fishery. The recreational white shark fishery is by regulation a catch-and-release fishery only and white sharks are not considered bycatch.

Bycatch can result in death or injury to discarded fish and bycatch mortality should be incorporated into fish stock assessments and evaluation of management measures. Rod and reel estimates from Virginia to Maine during June through October can be monitored through expanding survey data derived from the LPS (dockside and telephone surveys). Actual numbers of fish discarded for many species are so low that presenting these data by area may be misleading, particularly if estimates are expanded for unreported effort in the future. The HMS FMP presented the "raw" data for bycatch species in the rod and reel fishery from the 1997 LPS database in summary format (for all areas) in Table 3.38. This table is updated below to include preliminary 1998 data.

Table 4.4.4 **Reported Discards* of HMS in the Rod and Reel Fishery.** Source: Large Pelagic Survey (LPS) Preliminary Data, 1997 data from 3538 total dockside intercepts, 1998 data from 3095 total dockside intercepts.

Species	Number of Fish Kept		Number of Fish Discarded Alive		Number of Fish Discarded Dead	
	1997	1998	1997	1998	1997	1998
White Marlin**	7	11	203	465	0	0
Blue Marlin**	2	3	30	27	0	0
Sailfish**	0	1	2	2	0	0
Swordfish	5	1	6	5	0	0
Bluefin Tuna	749	653	1,181	1,105	12	11
Bigeye Tuna	17	17	6	9	6	18
Yellowfin Tuna	1,632	2646	224	645	8	3
Skipjack Tuna	285	261	468	267	60	4
Albacore Tuna	189	558	43	92	2	1
Thresher Shark	3	7	2	2	0	0
Mako Shark	51	78	86	92	3	1
Sandbar Shark	5	2	30	56	1	0
Dusky Shark	16	6	50	54	0	0
Tiger Shark	0	2	5	5	0	1
Blue Shark	68	26	1,897	780	5	8
Hammerhead Shark	1	1	4	4	0	0
Wahoo	6	71	1	2	0	0
Dolphin	920	7263	61	194	0	2
King Mackerel	174	198	1	10	6	0
Atlantic Bonito	336	328	203	300	1	11
Little Tunny	587	1231	1,015	1507	17	5
Amberjack	3	6	18	40	0	0

*NMFS typically expands these “raw” data to report discards of bluefin tuna by the rod and reel fishery to ICCAT. If sample sizes are large enough to make reasonable discard estimates for other species, NMFS may estimate discard estimates of other bycatch species in future SAFE reports.

**The Billfish Amendment established billfish released in the recreational fishery as a “catch and release” program, thereby exempting these fish from bycatch considerations

Outreach programs were included as final actions in the HMS FMP and the Billfish Amendment as part of the management measures to address bycatch. These programs have not yet been implemented, but preparation of program designs are currently in progress. One of the key elements of the outreach program will be to provide information that leads to an improvement in post-release survival from both commercial and recreational gear.
Section 3.5.2.2 in the Billfish Amendment includes a review of available information on post-release mortality. Table 3.5.3 of the Billfish Amendment and Table 3.40 of the HMS FMP list the existing studies, their methods, and conclusions. Approximately 90 percent of blue marlin taken by U.S. recreational fishermen are released after capture, therefore, studies on post-release mortality are critical.

Since publication of the HMS FMP and the Billfish Amendment, several new studies have been initiated and/or completed which may improve bycatch information, as well as provide useful information to present in future outreach programs. A recent paper acknowledges that recent technological advances in tags, including those that release from the fish at a preprogrammed time and then transmit data to satellites, offer the potential for developing better estimates of release mortality (Goodyear, 1999a). This paper uses simulation techniques to examine factors leading to robust estimates of release mortality and contends that initial studies should focus on proving the technology. Each fishing mode is likely to have a different release mortality rate and each experiment will only estimate the release mortality rate for the species, gear, and fishing method employed in the fishery. Therefore, the number of tags required to estimate the total number of deaths of released fish of all species could be in the tens of thousands. However, the paper also notes that a well-researched experimental design might reduce the required number of tags significantly.

In another study, an evaluation of pop-up satellite tag technology to estimate post-release survival of blue marlin was recently conducted by the Virginia Institute of Marine Science (VIMS), Bermuda Division of Fisheries in the Department of Agriculture and Fisheries, and NMFS' Southeast Fisheries Science Center (SEFSC). Results of previous acoustic tracking studies in which blue marlin were followed up to several days suggest that mortality, when it occurs, usually happens within 48 hours of release. Pop-up satellite tags, which have been used to study the movements of bluefin tuna and marlin over time periods of one to several months, provide a potential tool to study post-release survival of billfish over shorter time periods. Nine pop-up satellite tags were deployed on blue marlin caught on recreational gear off the southwest coast of Bermuda. Fish ranged from 150 to 400 pounds, and were captured on rod and reel with trolled lures or skirted dead baits. Fight times ranged from fifteen to forty-five minutes and some individuals required resuscitation before release. Eight of the nine tags reported after five days at liberty. Data demonstrated that at least eight of the nine tagged fish were alive for the five days following their capture and release. The study also concluded that pop-up satellite tag technology is appropriate for estimating post-release survival of this species.

Summary results of the South Carolina Marine Game Fish Tagging program were presented at the August 1999 meeting of the American Fisheries Society (Davy, 1999). The Tagging Program has been in operation since 1974 through the South Carolina Department of

Natural Resources and relies on cooperating anglers to tag fish. Since its inception, over 800 blue marlin, 331 white marlin, 1218 sailfish, and 6,491 sharks have been tagged off the South Carolina coast. Recovery rates have been low, as is typical for HMS, and hover around the 1 percent mark. The study noted the dramatic increases in release of billfish species (98.5 percent in 1999 versus 26.9 percent in 1987) as well as the effects of minimum size limits. Nearly two-thirds of the sailfish and white marlin caught in 1999 were undersized, as were 85 percent of the blue marlin. Although the numbers of fish recovered from the tagging program are too low to establish general conclusions, results seem to indicate that billfish travel extensively and do survive after being released. Several cases were reported where specific fish had been boated in poor condition and went on to make full recoveries (as indicated by weight and general health at recovery).

In addition to the need for post-release mortality studies, the HMS FMP noted that scientific studies are also needed to determine the impact of various fishing practices on bycatch and bycatch mortality of billfish. Since publication of the HMS FMP, Dr. Eric Prince of the SEFSC has conducted an evaluation of the performance of circle and comparable size "J" hooks, primarily on Atlantic and Pacific sailfish. Hook types were assessed in terms of catch and hooking rates, hook location, hook damage, and amount of bleeding. Two basic types of recreational billfishing techniques were involved: trolling with dead natural bait and drifting or kite fishing with live natural bait. The portion of the study that involved trolling with dead bait took place off Iztaba, Guatemala during the months of March and April, 1999. A total of over 200 sailfish were caught on circle hooks and about 160 were caught on "J" hooks. Catch and hooking rates for Pacific sailfish were also compared between circle and "J" hooks using much larger sample sizes at the resort in previous years. In addition, numerous sailfish were caught using live bait in the south Florida sailfish fishery. This portion of the study provided some insight to possible differences in hook performance between circle hooks with and without an offset point. Some information on the use of circle hooks was also obtained for Pacific and Atlantic blue marlin. In general, circle hooks have an equal or slightly higher catch rate compared to equivalent size "J" hooks fished in a similar manner, although hooking techniques between hooks types are different. Circle hooks also minimize deep hooking and foul hooking, thus promoting the live release of these species.

A similar study by the Massachusetts Division of Marine Fisheries was recently conducted comparing circle and straight hooks relative to hooking location, damage, and success while catch and release angling for bluefin tuna. The objectives of the study were to statistically compare the performance of circle hooks to standard straight shank hooks relative to hooking rate, location, damage, and hook effectiveness in typical bluefin tuna 'chunk' fisheries as practiced along the East Coast. During the summers of 1997 and 1998, ten offshore fishing trips were made off the coasts of Virginia and Massachusetts to catch bluefin tuna using standard drifting and baiting techniques with circle hooks and straight shank hooks ranging in size 10/0-12/0 and 5/0-8/0, respectively. A total of 129 bluefin hooking events were recorded during the study, 69 on circle hooks and 60 on standard straight hooks. Of the hooked bluefin, 77 were successfully landed and dissected to assess damage. Statistically significant differences were found between the two hook types relative to hook location. Of the landed bluefin tuna, 91 percent of the 43 circle-hooked bluefin

tuna were hooked in the hinge of the jaw in contrast to 56 percent of the 34 straight-hooked bluefin tuna. The results of this study provide evidence that the use of circle hooks can reduce physical trauma associated with the catch and release of bluefin tuna. Additional sampling is planned for future seasons.

4.4.7 Safety Issues Associated with the Fishery

The USCG does not maintain statistics on boating accidents, rescue, or casualty data specifically pertaining to recreational fishing as it does for the commercial industry. As a result, the HMS FMP and the Billfish Amendment contain only minimal safety information regarding this fishery. However, the USCG does compile statistics on recreational boating accidents and casualties, independent of the activity in which they are engaged. Coast Guard Safety Officer and Recreational Boats Safety Specialist, Lieutenant Keirsten Current cited two common situations that place recreational boaters in potential danger. Individuals in small vessels often venture out farther than the vessels are designed without the proper navigational equipment and may encounter rougher water than their boats can handle. Since fishermen targeting HMS species, particularly marlin, often travel at least 75 to 100 miles offshore, having a properly equipped vessel of adequate size is very important for the safety of recreational HMS constituents. The other situation that the Lieutenant noted as a frequent safety concern of the Coast Guard is when someone is up in the flybridge. Both of these situations can lead to people falling overboard. In 1997, approximately 70 percent of all boating casualties were due to drowning and in approximately 90 percent of all the drowning deaths, the victim was not wearing a personal floatation device (PFD).

Table 4.4.5 1997 Reported Boating Casualties. Source: USCG Lt. Current, personal communication.

Age Groups	# of Drowning Fatalities (victim was wearing a PFD)	# of Drowning Fatalities (victim was not wearing a PFD)	Total Number of Drowning Fatalities	# of Fatalities not due to Drowning
0-12	0	14	14	11
13-19	4	36	40	15

20-29	15	91	106	36
30-39	13	98	111	58
40-49	12	97	109	41
50-59	7	76	83	19
60-69	9	40	49	14
70-79	4	24	28	5
≥80	1	5	6	7
Total	**65**	**521**	**586**	**233**

4.5 Fishery Data: ATLANTIC SHARKS

4.5.1 Overview of History and Current Management

Atlantic sharks are targeted primarily through bottom longline, drift gillnet, and rod and reel gear types. Although discussions on other fisheries have been broken down by gear type, the nature of the shark catch and the method of data collection lend themselves to a stock-based analysis. As a result, some of the information overlaps with that found in other sections of the report.

The HMS FMP contained numerous new management measures for Atlantic sharks, including rebuilding programs for ridgeback and non-ridgeback large coastal sharks (LCS) and precautionary measures for pelagic and small coastal sharks (SCS). Specifically, the HMS FMP:

- Reduced the annual commercial quota for LCS to 816 mt dw, apportioned between ridgeback (620 mt) and non-ridgeback (196 mt) LCS.*
- Reduced the annual commercial quota for SCS to 359 mt dw.*
- Reduced the annual commercial quota for pelagic sharks to 488 mt dw and established a separate annual commercial quota of 92 mt dw for the porbeagle and an annual dead discard quota for blue sharks of 273 mt dw.*
- Established a minimum size of 137 cm fork length for ridgeback LCS in commercial fisheries.*
- Reduced the recreational retention limit to 1 shark per vessel per trip, with a minimum size of 137 cm fork length for all sharks, and an additional 1 Atlantic sharpnose shark per person per trip (no minimum size for Atlantic sharpnose sharks).
- Prohibited possession of 19 species of sharks (Atlantic angel, basking, bigeye sand tiger, bigeye sixgill, bigeye thresher, bignose, Caribbean reef, Caribbean sharpnose, dusky, Galapagos, longfin mako, narrowtooth, night, sand tiger, sevengill, sixgill, smalltail, whale and white).*
- Established a public display quota of 60 mt ww for all sharks.
- Established season-specific quotas and adjustments for the commercial fisheries.
- Accounted for all sources of mortality in establishing quota levels, including counting dead discards and landings in state waters after federal closures against federal quotas.*
- Scheduled fishery openings for specified periods in advance of fishery openings.

- Established 100 percent observer coverage in the shark drift gillnet fishery.**

- Created a new management subgroup of deepwater sharks and extended the prohibition on finning to this subgroup.

*Certain measures contained in the HMS FMP have been enjoined until further order of the Middle District Court, Tampa, FL.
**Due to funding constraints, NMFS has issued waivers to all known participants in the directed shark drift gillnet fishery.

As part of the implementation of the HMS FMP, NMFS announced on June 1, 1999 (64 FR 30248), that the ridgeback LCS fishery would open July 1, 1999, and close August 4, 1999, and that the non-ridgeback LCS fishery would open July 1, 1999, and close July 12, 1999.

On June 25, 1999, a coalition of shark fishermen and dealers sued NMFS on several of the new management measures regarding sharks. On June 30, 1999, NMFS received a Court Order from Judge Steven D. Merryday relative to the May, 1997, lawsuit challenging commercial harvest quotas for Atlantic sharks. This court order enjoined many of the new shark management measures that were to go into effect July 1, 1999, *except for* limited access (including incidental catch limits), trip limits (4,000 lb large coastal sharks), shark gillnet observer coverage, and all recreational shark measures. Therefore, the LCS commercial quota reverted to the 1997 level of 1,285 mt dw (all species of LCS included), with no minimum size on ridgeback LCS, and the pelagic and small coastal shark quotas also reverted to the 1997 levels. In addition, commercial shark fishermen are subject to the 1997 prohibited species list (white, basking, whale, sand tiger, and bigeye sand tiger) while the 1999 prohibited species list now applies to recreational fishermen only. On July 9, 1999 (64 FR 37883), NMFS changed the closure of the LCS fisheries to comply with the court order. Due to the injunction against ridgeback and non-ridgeback quotas, NMFS reevaluated the available quota and changed the closure for all LCS to July 28, 1999. On December 6, 1999, a motion to dissolve the injunction and for expedited consideration was filed.

On August 26, 1999 (64 FR 47713), NMFS announced that the LCS quota had not been reached and reopened the LCS fishery for the month of September. On September 30, 1999 (64 FR 53949), NMFS extended the fishery closure until October 15, 1999, due to preliminary estimates indicating that the LCS quota would not be reached by the end of September. As of November 16, 1999, dealer reports and state landing reports indicate that approximately 1,379.5 mt dw of LCS were landed in 1999 (approximately 694 mt dw from January - March, approximately 278.5 mt dw from July 1- July 28, and 407 mt dw from September 1 - October 15), which exceeded the annual quota, per court order, of 1,285 mt dw by approximately 94.5 mt dw, or 7.5 percent of the annual LCS quota. The impact of this quota overharvest on the LCS rebuilding program is unknown at this time.

On November 24, 1999 (64 FR 66114), NMFS announced the length of the commercial fisheries for the first semi-annual period of 2000; all commercial shark fisheries will open January

1, 2000, LCS will close March 31, 2000, and pelagic sharks and SCS will remain open until further notice. NMFS may close these fisheries earlier if harvest data indicate that the quotas will be reached earlier than projected.

4.5.2 Most Recent Catch and Landings Data

The 1999 Shark Evaluation Annual Report indicates that estimates of 1997 landings of large coastal, pelagic, and small coastal sharks (which were preliminary at the time the HMS FMP was prepared) have been finalized, and provides preliminary estimates of 1998 landings (see below). Notable revisions indicate that LCS landings in 1997 were approximately 400 mt dw higher than previously reported, and that landings in 1998 were approximately 249 mt dw higher than the final 1997 estimates. The 1999 Shark Evaluation Annual Report states that:

> Updated catches in numbers for 1997 are estimated to be higher than previously reported because complete landings statistics were not available at the time the original estimates were derived. Catches in numbers for 1998 are estimated to be about 14% higher than 1997 catches. Catch levels higher than the established quota in 1997 and 1998 are attributable to state landings after season closures, and Louisiana is the state with the highest landings.

The impact of these revised landings statistics on the LCS rebuilding program is unknown at this time. On the other hand, 1997 final estimates of pelagic and SCS landings were approximately 189 and 6 mt dw respectively, lower than previously reported and 1998 preliminary estimates are lower still.

Table 4.5.1 **Final Estimates of Total Landings and Dead Discards for Large Coastal Sharks: 1981-1998 (numbers of fish in thousands)***. Modified from 1998 Report of the Shark Evaluation Workshop. Changes from previously reported estimates are noted.

Year	Commercial Landings	Longline Discards	Recreational Catches	Unreported	Coastal Discards	Menhaden Fishery bycatch	Total
1981	16.2	0.9	265.0	N/A	N/A	N/A	282.1
1982	16.2	0.9	413.9	N/A	N/A	N/A	431.0
1983	17.5	0.9	746.6	N/A	N/A	N/A	765.0
1984	23.9	1.3	254.6	N/A	N/A	N/A	279.8
1985	22.2	1.2	365.6	N/A	N/A	N/A	389.0
1986	54.0	2.9	426.1	24.9	N/A	N/A	508.0
1987	104.7	9.7	314.4	70.3	N/A	N/A	499.0
1988	274.6	11.4	300.6	113.3	N/A	N/A	699.9
1989	351.0	10.5	221.1	96.3	N/A	N/A	678.8
1990	267.5	8.0	213.2	52.1	N/A	N/A	540.8
1991	200.2	7.5	293.4	11.3	N/A	N/A	512.4
1992	215.2	20.9	304.9	N/A	N/A	N/A	541.1
1993	169.4	7.3	249.0	N/A	17.6	N/A	443.3
1994	228.0	8.8	160.9	N/A	22.8	26.2 (26.2)	446.7 (26.2)
1995	222.4	6.1	176.3 (-7.1)	N/A	22.2	24.0 (24)	451.0 (16.9)
1996	170.5 (6)	5.7	188.5 (4)	N/A	17.0 (0.6)	25.1 (25.1)	406.8 (35.7)
1997	131.9 (33.5)	5.9 (0.3)	165.1 (3.2)	N/A	13.2 (3.4)	25.1 (25.1)	341.2 (65.5)
1998*	150.0	5.9	160.4	N/A	9.6	25.1	351.0

*For an explanation of the derivation of these estimates, see the 1999 Shark Evaluation Annual Update. 1998 estimates are preliminary.

Table 4.5.2 Preliminary vs Final 1997 Landings Estimates for Large Coastal Sharks.

Species	1997 Preliminary Estimates	1997 Final Estimates	Difference

Bigeye Sixgill	*29*	0	-29
Bignose	*2,132*	2,132	0
Blacktip	*1,503,356*	1,506,182	2,826
Bull	*40,247*	40,247	0
Dusky	*73,250*	80,930	7,680
Hammerhead	*62,955*	79,685	16,730
Lemon	*20,595*	20,595	0
Night	*57*	33	-24
Nurse	*8,864*	8,864	0
Reef	*3,548*	3,548	0
Sand Tiger	*7,920*	8,425	505
Sandbar	*863,574*	890,881	27,307
Silky	*13,920*	13,920	0
Spinner	*6,039*	6,039	0
Tiger	*5,312*	6,603	1,291
Unclassified	*359,148*	1,078,813	719,665
Unclassified Fins	*151,364*	140,638	-10,726
Whale	*3,598*	0	-3,598
White	*1,315*	1,315	0
Large Coastal	*0*	98,726	98,726
TOTAL	3,127,223	3,987,576	860,353
	(1,418 mt)	(1,809 mt)	391 mt

Table 4.5.3 1998 Landings of Large Coastal Sharks*.

	Commercial (lbs dw)	Recreational (number)
Bignose	50	none reported
Blacktip	1,893,805	76,522
Bull	27,389	802
Dusky	81,124	4,277
Hammerhead	59,802	384
Hammerhead, Great	none reported	441
Hammerhead, Scalloped	none reported	1,101
Hammerhead, Smooth	none reported	370
Lemon	23,232	1,992
Night	3,289	none reported
Nurse	2,846	2,690
Reef	100	none reported
Sand Tiger	38,791	none reported
Sandbar	1,077,161	33,245
Silky	13,615	5,039
Spinner	16,900	7,119
Tiger	12,174	1,302
Large Coastal	172,038	16,505
Unclassified	1,038,530	none reported
Unclassified fins	76,588	none reported
TOTAL	4,537,434	151,791
	(2,058 mt)	

*1998 estimates are preliminary.

Table 4.5.4 Preliminary vs Final 1997 Landings Estimates for Pelagic Sharks.

Species	1997 Preliminary Estimates	1997 Final Estimates	Difference
Bigeye Thresher	*5,308*	5,308	0
Blue	*967*	904	-63
Bonito (SF Mako)	*261,825*	224,362	-37,463
Cow	*81*	0	-81
Longfin Mako	*2,112*	7,867	5,755
Oceanic Whitetip	*3,656*	2,764	-892
Porbeagle	*3,690*	4,222	532
Thresher	*109,030*	145,253	36,223
Unclassified	*568,644*	74,849	-493,795
Mako	*0*	71,371	71,371
Pelagic	*0*	694	694
TOTAL	955,313	537,594	-417,719
	(433 mt)	(244 mt)	-189 mt

Table 4.5.5 1998 Landings of Pelagic Sharks*.

	Commercial (lbs dw)	Recreational (number)
Bigeye Thresher	1,403	none reported
Blue	706	6,003
Shortfin Mako	222,920	5,581
Longfin Mako	4,410	none reported
Mako	79,773	none reported
Oceanic Whitetip	22,049	none reported
Porbeagle	19,795	none reported
Thresher	102,530	36
Pelagic	111	none reported
Unclassified	49,502	none reported
TOTAL	503,199	11,620
	(228 mt)	

*1998 estimates are preliminary.

Table 4.5.6 Preliminary vs Final 1997 Landings Estimates for Small Coastal Sharks.

Species	1997 Preliminary Estimates	1997 Final Estimates	Difference
Atlantic Sharpnose	*256,632*	256,562	-70
Blacknose	*202,781*	202,781	0
Bonnethead	*75,787*	75,787	0
Finetooth	*184,141*	169,733	-14,408
Unclassified	*0*	51	51
TOTAL	719,341	704,914	-14,427
	(326 mt)	(320 mt)	-6 mt

Table 4.5.7 1998 Landings of Small Coastal Sharks*.

	Commercial (lbs dw)	Recreational (number)
Atlantic Angel	none reported	107
Atlantic Sharpnose	230,920	42,048
Blacknose	119,689	9,578
Bonnethead	13,949	26,191
Finetooth	267,224	none reported
Unclassified	82	none reported
TOTAL	631,864	77,924
	(287 mt)	

*1998 estimates are preliminary.

4.5.3 U.S. vs. International Breakdown of Landings

As previously stated, there is no comprehensive international reporting system for Atlantic shark catches and landings. While there are some international data, not all countries report and those that do use varying reporting methods. At this year's ICCAT meeting, the U.S. Delegation proposed that countries participate in collecting shark catch and bycatch data and assist the Food and Agriculture Organization of the United Nations (FAO) in their biological assessments. As mentioned in Section 2.5 the SCRS Subcommittee on Bycatch also requested that countries report shark catch and effort data. In addition, the United States advocated measures to prohibit shark finning and ensure the protection of juvenile sharks and their nursery areas.

4.5.4 Bycatch Issues and Data Associated with the Fishery

Shark Drift Gillnet Fishery

Updated information on catch and bycatch in the shark drift gillnet fishery off east Florida during the 1999 critical right whale season (November 15 - March 31) indicate that a total of 20 sets on 20 known vessels trips caught an estimated 2,923 animals. The catch consisted of 12 species of sharks, 21 species of teleosts and rays, and one species of marine mammal. Two species of sharks, blacktip and finetooth, made up 90 percent by number and 73 percent by weight of the observed shark catch (see below). Bycatch was dominated by crevalle jack, Spanish mackerel, tarpon, cobia, king mackerel, spotted eagle ray, and menhaden. Observers recorded 4

incidental takes of bottlenose dolphin in 2 different sets, all of which were released dead (Carlson and Lee, 1999).

Table 4.5.8 **Total Shark Catch in NMFS Observed Sets During 1999 Critical Right Whale Season**: Based on observations from January 8, 1999 - March 31, 1999.

Species	Total Number Caught	Percentage Kept	Discarded Alive (%)	Discarded Dead (%)
Blacktip	1,068	99.8	0	0.2
Finetooth	839	99.8	0	0.2
Bonnethead	393	45.8	0.2	54
Atlantic Sharpnose	238	98.7	0.4	0.9
Blacknose	28	100	0	0
Sandbar	19	94.7	0	5.3
Spinner	7	100	0	0
Bull	6	100	0	0
Hammerhead, Scalloped	5	20	0	80
Hammerhead, Great	2	100	0	0
Tiger	2	100	0	0
Lemon	1	100	0	0

Table 4.5.9 **Total Bycatch in NMFS Observed Sets During 1999 Critical Right Whale Season:** Based on observations from January 8, 1999 - March 31, 1999.

Species	Total Number Caught	Percentage Kept	Discarded Alive (%)	Discarded Dead (%)
Crevalle Jack	75	17.3	0	82.7
Spanish Mackerel	62	95.1	0	4.9
Tarpon	47	0	8.5	91.5
Cobia	30	100	0	0
King Mackerel	23	47.8	4.4	47.8
Spotted Eagle Ray	18	0	72.2	27.8
Menhaden	14	0	0	100
Cownose Ray	6	0	100	0
Gag Grouper	6	100	0	0
Tripletail	6	100	0	0
Sailfish	6	0	33.3	66.7
Barracuda	5	100	0	0
Pompano	4	100	0	0
Manta Ray	3	0	0	100
Atlantic Moonfish	2	0	50	50
Harvestfish	2	0	0	100
Butterfish	2	0	0	100
Black Margate	2	100	0	0
Lookdown	1	100	0	0
Atlantic Bonito	1	0	0	100
Little tunny	1	0	0	100
Weakfish	1	0	0	100
Bottlenose Dolphin	4	0	0	100

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5. COMMUNITY DATA UPDATE

According to National Standard 8 (NS 8), conservation and management measures should attempt to both provide for the continued participation of a community and minimize the economic effects on the community. Complying with NS 8 is contingent upon the availability of community studies and profiles as well as regional economic analyses. The information presented here complements the social and economic data contained in the fishery update sections of the report and highlights studies that have emphasized regional and state-specific assessments.

5.1 Overview of Current Information and Rationale

The Magnuson-Stevens Act requires all FMPs to include a fishery impact statement intended to assess, specify, and describe the likely effects of the measures on fishermen and fishing communities (§303(a)). When establishing any new regulations, the cultural and social framework relevant to the fishery and any affected fishing communities (§303(b)(6)) must be taken into account.

The National Environmental Policy Act (NEPA) also requires federal agencies to consider the interactions of natural and human environments by using "a systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences ... in planning and decision-making" (NEPA §102(2)(a)). Federal agencies should address the aesthetic, historic, cultural, economic, social, or health effects of regulations which may be direct, indirect, or cumulative. Consideration of the social impacts associated with fishery management measures is a growing concern of managers as fisheries experience variable participation and are affected by declines in stocks.

Social impacts are defined as the consequences to human populations that follow from some type of public or private action. These consequences may include changes in "the ways in which people live, work or play, relate to one another, organize to meet their needs and generally cope as members of a society ... " (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment, 1994:1). In addition, cultural impacts may involve changes in the values and beliefs that affect the way people identify themselves within their occupation, their communities, and society in general. Social impact analyses help determine the consequences of policy action in advance by comparing the status quo with the projected impacts. Public hearings, scoping meetings, and Advisory Panel meetings provide input from those concerned with the impacts of a proposed management action.

While geographic location is an important component of a fishing community, management measures often have the most identifiable impacts on fishing fleets that use specific gear types. In addition, since the species managed by the HMS FMP are by definition highly migratory, fishermen tend to shift locations in an attempt to follow the fish. The geographic concentrations of HMS fisheries may also vary from year to year as the behavior of these migratory fish is somewhat unpredictable. The relationship between these fleets and geographic

fishing communities is not always a direct one. As a result, the inclusion of typical community profiles in HMS management decisions is somewhat difficult.

NMFS (1994) guidelines for social impact assessments specify that the following elements are utilized in the development of FMPs and FMP amendments:

1. Information on distributional impacts, non-quantifiable considerations such as expectations and perceptions of the alternative actions, and the potential impacts of the alternatives on both small economic entities and broader communities;

2. Descriptions of the ethnic character, family structure, and community organization of affected communities;

3. Descriptions of the demographic characteristics of the fisheries;

4. Descriptions of important organizations and businesses associated with the fisheries;

5. Identification of possible mitigating measures to reduce negative impacts of management actions on communities.

To help develop this information for the HMS FMP and the Billfish Amendment, NMFS contracted with Dr. Doug Wilson, from the Ecopolicy Center for Agriculture, Environmental and Resource Issues at Rutgers, the State University of New Jersey. Dr. Wilson and his colleagues completed their field work in July 1998. This study covered four species groups (tunas, swordfish, sharks, and billfish) that have important commercial and recreational fisheries extending along the Atlantic and Gulf coasts from Maine to Texas and in the Caribbean. The study investigated the social and cultural characteristics of fishing communities in five states and one U.S. territory: Massachusetts, New Jersey, North Carolina, Florida, Louisiana, and Puerto Rico. These areas were selected because they each have important fishing communities that could be affected by measures included in the HMS FMP and the Billfish Amendment, and because they are fairly evenly spread along the Atlantic and Gulf coasts and the Caribbean. For each state or territory, a profile of basic sociologic information was compiled, with at least two coastal communities visited for further analysis. Towns were selected based on HMS landings data, the relationship between the geographic communities and the fishing fleets, and the existence of other community studies. Finally, the Advisory Panels for HMS and Billfish provided extensive input on which fishing communities should be included in this analysis. Complete descriptions of the study results can be found in Chapter 9 of the HMS FMP and Chapter 7 of the Billfish Amendment.

5.2 Summary of New Social and Economic Data Available

Survey of Commercial Fishermen by National Fisherman Magazine (December, 1998)

National Fisherman Magazine sampled more than 3,500 individuals to provide an assessment of America's commercial fishermen (Fraser, 1998). Surveys were allocated by state in accordance with 1990 U.S. Census estimates of the percentages of commercial fishermen in each state. The National Fisherman survey asked participants 21 questions and conducted personal interviews to assess demographic information, views on management, and outlooks on the future of the commercial fishing industry.

According to all respondents, the industry is much smaller than it was even a few years ago. In fact, the U.S. Bureau of Labor Statistics recently reported a decrease in the numbers of commercial fishermen from 59,000 in 1992 to less than 47,000 in 1996. The large majority of commercial fishermen were male (95 out of 100) and, while 52 percent were 45 or older, only 7 percent of those responding were under 30 years old. Fifty-one percent of fishermen sampled had been fishing more than 20 years and over 80 percent had been fishing 11 years or longer. Forty-five percent of fishermen have seen their income from fishing decrease since they began fishing and 38percent have seen an increase. Thirty-three percent of fishermen expected fishing to earn them up to $24,999 in 1998. Thirty-two percent expected to earn between $25,000 and $49,999. Fifty three percent of fishermen belong to a fishermen's association, 33 percent have never belonged, and 11 percent did belong but dropped out. Eighty-one percent of fishermen describe their outlook on the future of commercial fishing as fearful to very fearful, although 69 percent foresaw working as a commercial fisherman until retirement. Seventy-nine percent would not recommend commercial fishing as a future occupation for their sons or daughters.

Compared to when they first began fishing, 88 percent of fishermen paid more attention to legislative matters that affect their fishery. When asked, "Who or what do you consider the greatest threat to the longevity of your career in fishing?", 31 percent replied NMFS, 28 percent replied environmental activists, 26 percent stated overfishing/overcapitalization, 20 percent said sport fishermen, 15 percent said competition in the market, and 11 percent replied other. Seventy-one percent of fishermen disagree or strongly disagree with the statement that, "Fisheries are managed in a manner that promotes maximum sustainability into the future." Eighty-two percent of fishermen are not confident in NMFS' ability to manage the country's fisheries. When asked, "What method do you favor most for limiting/reducing fishing effort?", 42 percent favored limited entry, 18 percent favored individual fishing quotas, 17 percent replied buybacks, 14 percent said that access should not be limited, and 9percent noted " other". Fifty-five percent feel that fishermen are not accurately portrayed in the media.

Although it is difficult to determine specific implications for HMS management from a general survey, responses on preferred management techniques, level of participation in the process, and outlooks for the future can be helpful as guidelines. Commercial fishermen can be

identified as a community in respect to some of their attitudes towards their work and typical characteristics. It is important to acknowledge these traits to produce management measures that are most amenable to, and supportive of, the typical commercial fisherman.

*NMFS Office of Science and Technology Socioeconomic Fishing Survey*s

NMFS conducted two separate socioeconomic surveys in order to provide demographic and economic data on marine recreational fishermen. Basic demographic information included age, education, employment status, and income distribution. Economic data consisted of estimated boat and travel expenses as well as distance traveled to reach a particular fishing destination. In addition, participants were surveyed on their management preferences. Data were collected and analyzed by individual state. Survey results pertaining to the "Big Game" category of recreational fishing are discussed further in Section 4.4.4.

Marine recreational fishermen from Maine through Virginia's recreational were surveyed during May through December of 1994. Anglers were asked a few questions during routine MRFSS intercept interviews. Several additional socio-demographic questions, as well as questions about management preference, were asked during follow-up telephone interviews with willing participants. Over 22,000 economic intercept add-on surveys were completed, and over 8,000 individuals participated in the telephone follow-up survey.

In March 1997 to February 1998, recreational fisherman from North Carolina through Louisiana were surveyed. Data were collected to provide demographic and economic data on marine recreational fishing participants and followed the same protocol as the 1994 survey. In total, over 33,000 economic intercept add-on surveys were conducted. Of these, over 10,000 individuals were administered the telephone follow-up survey.

Survey results are helpful in identifying baseline characteristics of the East and Gulf Coast marine recreational fisheries. There is a wide variety of recreational fisheries in each state and fishermen that target HMS are typically a small percentage of the total. As a consequence, these studies were not used in the HMS FMP and are mentioned here primarily as an interesting example of a type of community study. A state-by state-assessment of HMS recreational fisheries would be valuable and is something that NMFS is considering as a future project.

5.3 Future Trends

Social impact analyses should continue to be conducted and refined in terms of the techniques employed and how they can be best used by management. The following data were described by Brainerd et al. (1996) as being essential in order to characterize individual ports as distinct communities and to assess levels of regional cohesion. "Census" in this case refers to taking data from all ports in the region, not all persons within a community. "Sample" refers to a

subset of ports. The census and other public data, combined with per-trip crew information, will allow fisheries managers to estimate regional differences in fishing effort and movement between fisheries. In addition, it will allow assessment of differing social service, employment, and retraining needs in different communities. The ethnographic data will further understanding of regional and even extra-regional patterns of fishing and attitudes toward fishing and fisheries management, as well as the place of fishing within individual communities. These data will also provide the detailed information necessary to allow fishers' knowledge of fishing and the environment to be usefully incorporated into fisheries management.

Table 5.1 Community Data Collection

Data Element	Census (C) or Sample (S)	Frequency	Collection Method
Demographic Data			
By smallest available aggregations	C	Based on the public data source frequency	U.S. Census and municipal data
Population levels	C	" "	" "
Age / sex breakdown	C	" "	" "
Vital statistics (births, deaths, net in-out migration)	C	" "	" "
Racial / ethnic composition	C	" "	" "
Welfare rates	C	" "	" "
Crime rates	C	" "	" "
Availability and character of health and other community services	C	" "	" "
Education levels	C	" "	" "
Average family size	C	" "	" "
Language use	C	" "	" "
Income levels (average and by occupational category)	C	" "	" "
Housing costs	C	" "	" "
Sociocultural Data			
Community social and cultural events related to fishing, and the level of participation by fishing and non-fishing members of the community	Census initially, then sample	Every 3 to 5 years	ethnographic studies (including focus groups, network analysis, participant observation)
Views on and experiences with fisheries managers and management in general, and on specific types of fisheries regulations of both fishing and non-fishing communities.	" "	" "	" "

Data Element	Census (C) or Sample (S)	Frequency	Collection Method
Local (sometimes called "traditional") ecological knowledge of harvesters	" "	" "	" "
Multi-generational fishing patterns and perceived importance of generational continuity in the fishery	" "	" "	" "
Existence and importance of fishing community ties to other fishing communities through kinship, shared festivals, history of joint fishing fleets or grounds, or other means	" "	" "	" "
Existence and importance of conflicts among stakeholder communities	" "	" "	" "
Sources of information on current and proposed fisheries management measures	" "	" "	" "
Perceptions of the fishing industry within the broader community and region	" "	" "	" "

In addition, regional economic impact assessments (EIAs) provide a means to predict how anglers' behavior affects the economic activity of a specific region. An EIA can be relied on as a key component in satisfying NS 8 as well as the Regulatory Flexibility Act. EIAs are a relatively recent advent in fishery management and are still in the development stages. A recent journal article titled "Regional Economic Impact Assessments of Recreational Fisheries: An Application of the IMPLAN Modeling System to Marine Party and Charter Boat Fishing in Maine" urges caution in the use of EIAs (Steinback, 1999). Without knowledge of the interactions and assumptions in the variables, the model results may not reflect an accurate portrayal of the region. Steinback uses an analysis of Maine's charter industry to explore how more consistent and accurate techniques can be incorporated in regional EIAs. As the techniques and data necessary to conduct a community EIA become further refined, they can be better integrated into a management framework and used to explore the effects of proposed alternatives.

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6. FISH PROCESSING, INDUSTRY, AND TRADE

It is important to track the marketing of HMS in order to adequately assess the impacts of conservation and management measures on stocks as well as the people and companies that depend on stock production and harvest. NMFS collects detailed information about U.S. caught HMS from fishermen in the form of observer data and logbook data. In addition, detailed information regarding some species is collected from the first receiver or dealer. NMFS also collects detailed information about certain imported HMS but cannot ascertain the details surrounding the harvest of some species unless the harvesting country submits those data to ICCAT or other regional/global organizations such as the Food and Agriculture Organization of the United Nations (FAO). Because there are "missing links" surrounding the harvest, processing, and trade of HMS, NMFS cannot recreate information about stock production based on trade data. Nevertheless, trade data can be used to update information on international and domestic activities related to these fisheries.

6.1 Overview

The processing and trade-related entities that depend on Atlantic HMS are as diverse as the species themselves. Processing ranges from the simple process of dressing and icing swordfish at sea, to elaborate grading and processing schemes for bluefin tuna, to preserving shark fins. Like all other seafood, HMS are perishable and may pose health hazards if not handled properly. Products range from those having a long shelf-life, such as swordfish, to highly perishable species like yellowfin tuna. Improperly handled yellowfin can produce histamine, large swordfish may contain high levels of mercury, and shark meat requires careful handling due to the high concentrations of urea in the body of the shark. Processing companies are aware of these characteristics and their costs of doing business vary accordingly to protect consumers.

Transportation of these species to market also varies widely from the direct domestic sale of some shark or swordfish meat by a fisherman to a restaurant (carried by truck) to the quick and sometimes complicated export of bluefin tuna from fisherman to dealer to broker to the Japanese auction (carried by commercial airline carrier). Frozen swordfish and tunas are often brought to the United States by overseas shipping companies and sharks and other products may be exported from the United States, processed overseas, and imported in a final product form.

It is unknown how many U.S. companies depend on HMS fisheries, other than those who buy fish directly from U.S. fishermen and those who import bluefin tuna or swordfish. The proportion of those companies that depend solely on Atlantic HMS versus those that handle other seafood and/or products is also unknown. This section provides a summary of the most recent

trade data NMFS has analyzed, as well as a brief description of the processing and trade industries employed in transitioning Atlantic HMS from the ocean to the plate.

Processing and Wholesale Sectors

Quantitatively, NMFS has limited information on the processing sector, i.e., the amount of HMS products sold in processed forms. In addition, knowledge regarding the utilization of Atlantic HMS is largely limited to the major product forms. For example, bluefin tuna are usually shipped and sold in dressed form at fish auctions in Japan. Information on the processing sector of the Atlantic bluefin tuna fishery is detailed in the HMS FMP (Section 2.2.4.1). Other Atlantic tunas, especially bigeye tuna, are frequently shipped fresh to Japan in dressed form. Swordfish are sold fresh and frozen in dressed form and processed products (e.g., steaks and fillets). The utilization of sharks is also not well known since trade statistics frequently do not indicate product forms such as skins and leather, jaws, fishmeal and fertilizer, liver oil, and cartilage (Rose, 1996). Domestically-landed sandbar and blacktip shark meat may be sold to supermarkets and processors of frozen fish products. NMFS continues to work with industry to collect information specific to U.S. and foreign processing of Atlantic HMS to better track markets, conserve stocks, and manage sustainable fisheries.

The U.S. processing and wholesale sectors are dependent on both the U.S. and international HMS fisheries. Individuals involved in these businesses buy the seafood, cut it into pieces that transform it into a consumer product, and then sell it to restaurants or grocery store chains. Employment varies widely among processing firms and may be seasonal unless the firm relies on imported seafood or a wide range of domestic seafood. The majority of firms handle other types of seafood and are not solely dependent on HMS. Other participants in the commercial trade sector include brokers, freight forwarders, and carriers (primarily commercial airlines, trucking, and shipping companies). Swordfish, tunas, and sharks are important commodities on world markets, generating significant amounts in export earnings in recent years.

Monitoring International Trade of HMS

Understanding the harvesting and processing sectors is essential when analyzing world trade in highly migratory fish species. Trade data for Atlantic HMS are of limited use as a conservation tool unless they indicate the flag of the harvesting vessel, the ocean of origin, and the particular species landed. Under the authority of the Atlantic Tunas Convention Act and the Magnuson-Stevens Act, NMFS collects this information while monitoring international trade of bluefin tuna and swordfish. The bluefin tuna and swordfish monitoring programs implement ICCAT recommendations and support rebuilding efforts by collecting data necessary to identify nations and individuals that may be fishing in a manner that diminishes the effectiveness of ICCAT fishery conservation and management measures.

Of the Atlantic HMS, the international trade of bluefin tuna is perhaps the most well-tracked. This is due to international adoption of an ICCAT recommendation to implement the Bluefin Statistical Document (BSD) program. This process is bolstered by Japan's support for the program as a major importer of bluefin tuna. Each bluefin tuna is tagged and documented and the BSD travels with each shipment until the final point of destination (see Appendix II for a copy of the U.S. BSD). This document tracks *imports* and *exports* of bluefin tuna by most ICCAT nations. If bluefin tuna are exported from, or imported to, the United States, the document is submitted to NMFS as part of the monitoring program.

Since the late 1970's, NOAA Form 370 has been used to document imports of yellowfin tuna and other species of tuna for the purposes of protecting dolphins in the eastern tropical Pacific Ocean. Form 370 is filed with other documents necessary for entry into the United States and is then forwarded to NMFS's Southwest Regional Office. The form is **not** required for fresh tuna, animal food, or canned petfood made from tuna.

The United States also monitors the trade of swordfish, but only as it relates to the sale of Atlantic swordfish in U.S. markets. Monitoring U.S. imports of swordfish is facilitated by the use of U.S. Customs data, the Certificate of Eligibility (COE), and importer activity reports. While this program is approved by ICCAT through a recommendation allowing countries to ban the sale of swordfish less than their minimum size, the United States is currently the only country tracking imported shipments of swordfish. If swordfish shipments enter the United States under the swordfish tariff codes required by U.S. Customs regulations, the shipments can be cross-checked with a COE that indicates the flag of the harvesting vessel and the ocean of origin. Furthermore, the COE validates that the imported swordfish were not less than the U.S. minimum size of 33 lb dressed weight.

6.2 Exports

NMFS monitors exports of fish products through its Office of Science and Technology. Bureau of the Census data are made available online at www.st.nmfs.gov/st1/trade/index. NMFS also collects detailed export data on Atlantic bluefin tuna, most of which are exported to Japan and all of which are accompanied by a bluefin statistical document. "Exports" may include merchandise of both domestic and foreign origin. Census defines exports of "domestic" merchandise to include commodities which are grown, produced, or manufactured in the United States (e.g., fish caught by U.S. fishermen). For statistical purposes, domestic exports also include commodities of foreign origin which have been altered in the United States from the form in which they were imported, or which have been enhanced in value by further manufacture in the United States. The value of an export is the f.a.s. (free alongside ship) value defined as the value at the port of export based on a transaction price including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. It excludes the cost of loading the merchandise, freight, insurance, and other charges or transportation costs beyond the port of exportation.

Bluefin Tuna Exports

As described above and in the HMS FMP, all bluefin tuna imported to, or exported from, the United States must be accompanied by a BSD in order to meet the requirements of ICCAT's BSD program. The United States has participated in the program since 1995 and Table 6.1 summarizes the most recent information.

Table 6.1 **United States Exports of Bluefin Tuna (Atlantic and Pacific)**. As reported through the Bluefin Tuna Statistical Document Program, 1996 - 1998. U.S. BSD Program, NMFS NERO.

	Landings of Atlantic BFT (mt dw)	Exports of Atlantic BFT (mt dw)	Exports of Pacific BFT (mt dw)	Total U.S. Exports of BFT (mt dw)
1996	749.8	661.7	60.7	722.4
1997	826.8	698.7	917.3	1,616.0
1998	849.1	658.6	694.2	1,352.7

Information on exports of bluefin tuna for the first half (January through June) of 1999 is also available. Preliminary data indicate that 18.2 mt of west Atlantic bluefin tuna, and 10.4 mt of Pacific bluefin tuna were exported from the United States during this time period. These figures are similar to past years, as most landings (and exports) of bluefin tuna in the United States occur during the second half of the calendar year.

Shark Exports

NMFS also collects trade data on the export of sharks, although not in the level of detail found in the BSD program. Shark bycatch information is submitted to ICCAT but there are no management regarding shark conservation and management. Other regional entities, including the FAO, work to conserve sharks worldwide and gather trade information on shark species. Shark exports are not identified by species code with the exception of dogfish. In addition, they are not identified by specific product code other than fresh or frozen meat and fins. Shark shipments are not identified with respect to the flag of the harvesting vessel or the ocean of origin. Due to the popular trade in shark fins and their high relative value compared to shark meat, shark fins are tracked as a specific product code by U.S. Customs. In 1998, exported shark fins averaged $8.95/kg. In that same year, fresh and frozen shark meat averaged $1.55 and $2.43/kg, respectively. Table 6.2 indicates the magnitude of shark exports by the United States from 1995-1998. Prior to 1995, dogfish and all other sharks were grouped into one tariff code. Because dogfish has dominated the export market in volume for sharks during that time, these numbers are not useful for the purposes of this report (dogfish are not in the Atlantic shark management unit),

and are not included here. Sharks are targeted in the coastal Pacific Ocean by the driftnet thresher fishery and are caught incidental to the Bering groundfish (trawl) and tuna and swordfish longline fisheries in the Western Pacific Ocean. However, the Atlantic fishery catches a large number of sandbar and blacktip sharks which are thought to be sold domestically. As a result, it is unknown what percentage of total exports can be attributed to the Atlantic fishery.

Table 6.2 1995-1998 U.S. Exports of Shark Products (kg). Bureau of Census data.

Year	Shark Fins Dried (kg, US$)*		Non-specified Fresh Shark (kg, US$)		Non-specified Frozen Shark (kg, US$)	
1995	NA	NA	99,101	303,319	309,705	929,787
1996	NA	NA	640,677	1,342,273	358,000	969,955
1997	NA	NA	459,542	920,887	439,992	884,588
1998	141,149	1,264,077	524,249	814,319	102,939	250,107

* There was no product code for the export of shark fins prior to 1998. Therefore, any exported shark fins may have been identified as unspecified shark product or as unspecified dried fish.

It should be noted that there is no tracking of other shark products besides meat and fins. Therefore, NMFS cannot track trade in shark leather, oil, or shark cartilage products. Additionally, the United States has reported its imports of shark fins since 1964 but has only recently obtained a tariff code for exporting shark fins. Until that time, they were classified under a general heading.

Summary of Atlantic HMS Exports

Atlantic HMS exports are dominated by bluefin tuna and sharks. According to the *Fisheries of the United States, 1998*, 3,021 mt ww of bluefin tuna were landed in the United States in 1998 from all oceans. When converted to mt dw (using a factor of 0.7519), and compared with 1998 data from U.S. BSD program, it appears that roughly 59 percent of bluefin tuna landed in the Unites States was exported. The nature of reporting on sharks, particularly distinctions between fins and whole fish, makes comparison too difficult. However, overseas markets provide a profitable outlet for many U.S. Atlantic HMS fishermen and may provide superior markets compared with those found in the United States.

6.3 Imports

All seafood import shipments are required to be accompanied by a 7501 Customs entry form. The information submitted on this form is analyzed by NMFS and that data are available online at www.st.nmfs.gov/st1/trade/index. As mentioned on the web page, two methods are used to track imports: "general" imports are reported when a commodity enters the country, and "consumption" imports consist of entries into the United States. for immediate consumption combined with withdrawals from Customs bonded warehouses. “Consumption” import data reflect the actual entry of commodities originating outside the United States into U.S. channels of consumption. These are the data used by NMFS. Additional detailed information is collected by NMFS on bluefin tuna and swordfish imports and is discussed in further depth below.

Bluefin Tuna Import Monitoring Program

Similar to exports, Table 6.3 updates information in the HMS FMP on imports and re-exports (products imported and then forwarded on to another country) of bluefin tuna into and from the Untied States.

Importers of bluefin tuna are required to obtain an annual tuna dealer permit and to report through the BSD program. Since 1997, NMFS has received U.S. Customs data (derived from Entry Form 7501) on imports of fresh and frozen bluefin tuna and swordfish on a monthly basis. These data allow NMFS to track shipments of bluefin tuna and enforce dealer reporting requirements. United States imports and re-exports of bluefin tuna for 1996 through 1998, as reported through both U.S. Customs and the BSD program, are shown in Table 6.4. The difference in import numbers between the U.S. Customs and BSD data may be explained by a lack of knowledge and compliance with the BSD program by importers, especially those on the Pacific coast. As awareness of the BSD program improves among importers, the gap between imports reported through the BSD program and Customs has narrowed, but is still quite large.

Data transferral between NMFS and U.S. Customs helps NMFS verify the bluefin tuna import data it currently receives from dealers and identify those importers who are not in compliance with the BSD program. In general, industry sources report that imports of bluefin tuna into the United States are on the rise as the international value of the dollar remains high and the Asian economic crisis continues. The recent rise in the popularity of raw tuna in the United States has also prompted increasing imports of bluefin tuna and dealers are reporting an expanded domestic market for both locally-caught and imported raw tuna. Improvements in BSD compliance combined with the growing U.S. popularity of bluefin tuna are primarily responsible for the large differences between 1997 and 1998 imports shown in Table 6.4.

Table 6.3 **Imports of Bluefin Tuna into the United States**. As reported through the BSD program and U.S. Customs, 1996 - 1998.

	U.S. BSD Program		U.S. Customs Data (mt dw)
	Imports (mt dw)	Re-exports (mt dw)	
1996	1.9	1.3	N/A
1997	5.3	0.4	109.5
1998	99.9	1.9	225.6

Information on imports and re-exports of bluefin tuna for the first half (January through June) of 1999 is also available. Preliminary data indicate that 55.7 mt were imported into the United States, and an additional 4.1 mt were re-exported during this period.

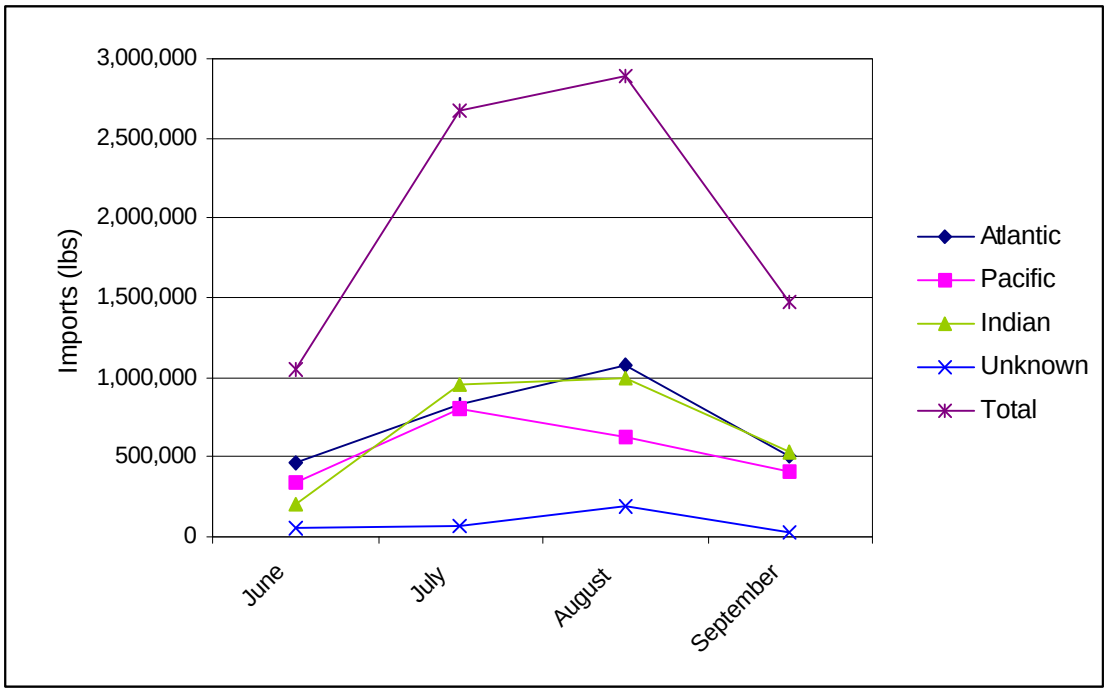
Swordfish Import Monitoring Program

Since the United States is a dominant swordfish market and demand for swordfish may provide incentive for nations to export Atlantic swordfish to the United States, NMFS reports imports of swordfish to ICCAT every year in November as part of the U.S. National Report. Data are collected from Customs entry forms, certificates of eligibility, and U.S. importer activity reports. Data from each source are compiled and cross-checked against other sources to confirm documentation of each shipment. For example, if a swordfish shipment enters the United States, NMFS receives general data about that shipment (exporting country, date of entry, weight of shipment, general product form) on the entry form. NMFS could then ensure that an importer activity report had been submitted detailing prices and specific product forms. NMFS could also check for a Certificate of Eligibility accompanying the shipment to indicate the flag of the harvesting vessel (sometimes different from exporting country), ocean of origin, and verification that, if it was an Atlantic swordfish, it weighed more than 33 lbs dressed weight when harvested. Table 6.4 and Figure 6.1 summarize the bi-weekly dealer report and the COE data for June-September. The July and August peak in import levels may be attributable to increased demand of swordfish during the "summer grilling season".

Table 6.4 **Swordfish Import Data Collected under the Swordfish Import Monitoring Program (lbs)**. June - September 1999 totals. Based on data received through November 15, 1999.

Flag Country of Harvesting Vessel	Ocean of Harvest				Total
	Atlantic	Pacific	Indian	Unknown	
Australia	0	394060.3	72900.7	6938.8	473899.8
Brazil	796966.8	0	0	0	796966.8
Canada	565248	0	0	0	565248
Chile	0	901326.5	0	0	901326.5
Columbia	0	192.5	0	0	192.5
Costa Rica	0	257504.3	0	0	257504.3
Ecuador	0	52658.3	0	0	52658.3
El Salvador	0	8768	0	0	8768
Fiji Islands	0	52017.6	0	0	52017.6
Grenada	2607	0	0	0	2607
Guam	0	1905	0	0	1905
Indonesia	0	0	74854.3	0	74854.3
Japan	0	163100	0	0	163100
Mexico	0	101845.4	0	0	101845.4
Micronesia	0	542	0	0	542
Namibia	0	0	0	0	0
Netherlands	1597	0	0	0	1597
New Zealand	0	177731.9	0	0	177731.9
Panama	0	243.9	0	0	243.9
Peru	929.4	2374	0	0	3303.4
Philippines	0	30568	0	0	30568
Samoa	0	1204	0	0	1204
South Africa	1262258	0	0	0	1262258
Taiwan	100348	29400	2537219	0	2666967
Trinidad	837	0	0	0	837
Uruguay	156845.1	0	0	0	156845.1
Vietnam	0	5044.1	0	0	5044.1
Unknown	0	0	0	332113.7	332113.7
Totals	2887636.2	2180485.8	2684974.1	339052.5	8092148.6

Figure 6.1 **Swordfish Import Data Collected under the Swordfish Import Monitoring Program (lbs).** June - September 1999. Based on data received through November 15, 1999.



Shark Imports

The United States imports both fresh and frozen shark meat. These imports and shark fins can be tracked using data from the Customs 7501 entry form. NMFS does not require importers to submit additional data regarding shark shipments. These meat products are reported to be high-quality and are supplied to restaurants and other seafood dealers that import other high-quality seafood products (Rose, 1996). NMFS does not have specific product information on imported shark meat such as the proportion of fillets, steaks, or loins. NMFS also has no data on imports of the condition of shark fins; i.e., wet, dried, or further processed products such as canned shark fin soup. The United States may be an important trans-shipment port for shark fins; shark fins may be imported wet and then exported dried. It is also probable that U.S.-caught shark fins are exported to Hong Kong or Singapore for processing, then imported back into the United States for consumption by urban-dwelling Chinese Americans (Rose, 1996). There is no longer a separate tariff code for shark leather, making it impossible to track imports of shark

leather through analysis data from the Customs 7501 entry form. Imports of frozen sharks have more than tripled since 1995 while imports of shark fins have decreased by approximately 50percent (by weight) (Table 6.5).

Table 6.5 1998 U.S. Imports of Shark Products

Year	Shark Fins Dried (kg, US$)		Non-specified Fresh Shark (kg, US$)		Non-specified Frozen Shark (kg, US$)	
1994	114,331	4,361,362	0	0	0	0
1995	142,235	2,348,411	1,255,512	3,577,897	46,889	558,201
1996	60,407	2,270,261	1,330,688	3,618,205	21,244	489,442
1997	77,626	3,060,438	1,191,044	3,044,984	59,641	914,783
1998	62,169	1,698,646	947,545	2,160,985	148,167	1,125,994

Summary of Imported HMS

Atlantic swordfish is an important U.S. import. According to the *Fisheries of the United States, 1998*, 6,846 mt ww of swordfish were landed in the United States in 1998 from all oceans. When converted to mt dw (using a factor of 0.7519), and compared with four months of 1999 data from the Swordfish Import Monitoring Program, it appears that roughly 71 percent of swordfish consumed in the Unites States may be imported. U.S. consumer preference continues to be a driving force for the world's swordfish fisheries and level of demand will no doubt play a role in future harvesting strategies. As Atlantic swordfish quotas decrease over the next few years to support rebuilding efforts, swordfish from the Pacific and Indian Oceans will continue to supply the U.S. market. Tunas are also imported in great quantity, although it is difficult to identify the source and species of processed tuna products. Bluefin tuna are frequently imported into the United States for transshipment to Japan, the dominant market for high-quality bluefin. However, tracking systems like the U.S. BSD program assist in providing NMFS with information on tuna trade.

6.4 The Use of Trade Data by ICCAT

The SCRS uses trade data on bluefin tuna, swordfish, and bigeye tuna that are submitted to ICCAT as an indication of increased landings. These data can then be used to augment estimates of fishing mortality rate (F) and produce better assessments. In addition, these data are

used to monitor compliance with ICCAT recommendations and identify those countries whose fishing practices diminish the effectiveness of ICCAT conservation and management measures. In 1996, ICCAT adopted a recommendation to address the lack of compliance with quotas in the bluefin tuna and north Atlantic swordfish fisheries. Penalties for contracting parties that are not in compliance may include catch limit reductions and, if necessary, trade restrictive measures. At the 1997 meeting, this was extended to apply to the South Atlantic swordfish fishery. An analysis of vessel sighting and Japanese BSD data led to the determination that Panama, Honduras, and Belize were fishing in a manner that diminished the effectiveness of the bluefin tuna rebuilding program. On August 21, 1997, NMFS implemented a 1996 ICCAT recommendation to prohibit the importation of Atlantic bluefin tuna and its products from Panama, Honduras, and Belize (62 FR 44422). Since that time, ICCAT has continued to communicate with these nations in an attempt to encourage compliance with ICCAT measures. In 1999, ICCAT recommended that the trade restrictions on Panama be lifted as a result of the Government of Panama's recent efforts to substantially reduce fishing vessel activities deemed inconsistent with ICCAT measures. Therefore, consistent with the ICCAT recommendation, NMFS proposes to lift the import restriction on Panama and allow for the importation of Atlantic bluefin tuna from that country.

Honduras and Belize are thought to have vessels that continue to fish in a manner that diminishes the effectiveness of ICCAT's conservation and management measures for both Atlantic bluefin tuna and Atlantic swordfish. In recent years, while other countries have reduced catch levels in response to the overfished status of North Atlantic swordfish, Honduras and Belize have recorded significant swordfish exports. In 1999, ICCAT received unsatisfactory responses from both governments regarding actions taken to rectify the situation. ICCAT recommended additional trade restrictions to address the concerns over swordfish landings. Therefore, consistent with the 1999 ICCAT recommendation, NMFS proposes to prohibit the importation of Atlantic swordfish and its products from Honduras and Belize. The prohibition of imports of Atlantic bluefin tuna and its products from these countries remains in effect.

In 1999, ICCAT also identified Equatorial Guinea (a Contracting Party to ICCAT) as a country whose vessels were diminishing the effectiveness of ICCAT conservation and management measures for Atlantic bluefin tuna. Import data from 1997-1999 reveal significant exports of Atlantic bluefin tuna by Equatorial Guinea despite the fact that the country had a zero catch limit during that time period. The Government of Equatorial Guinea has not responded to ICCAT inquiries and has reported no bluefin tuna catch data to ICCAT. As a result, ICCAT recommended trade restrictions as a penalty for non-compliance. Therefore, consistent with the 1999 ICCAT recommendation, NMFS proposes to prohibit the importation of Atlantic bluefin tuna and its products from Equatorial Guinea.

Ten countries were identified to be "hosting" illegal, unreported, and unregulated fishing vessels. These countries may be subject to trade sanctions in subsequent years. Thus, it is important to monitor international trade in HMS as these data can provide detailed information about unreported catches. The role of trade data in identifying countries which are fishing in a

manner that diminishes the effectiveness of ICCAT conservation and management measures will be increased as per the discussions and recommendations from the 1999 ICCAT meeting; dependent on the availability of data.

6.5 Conclusions and Future Plans

NMFS recognizes the limitations of using trade data to monitor conservation and management of HMS. However, NMFS has been successful at using these tools to collect more information about fisheries, harvesting practices, markets, and processors related to these species. Improved data collection depends on all harvesting nations and their ability and willingness to monitor fisheries and submit complete data sets to regional and global organizations such as FAO. These nations could potentially be assisted by the development of guidelines or standards for monitoring trade.

NMFS monitors trends in trade for all federally managed species and will identify any need for additional harmonized tariff codes. While a request for an additional tariff code is not always fulfilled, NMFS has been successful in the past to solicit a code for shark fins, and specific product codes for swordfish (e.g., fillets and steaks). The use of more detailed bluefin and swordfish trade data has recently proved to be an effective tool for monitoring international activities. Combined with vessel sighting information, these data provide clues about illegal, unreported, and unregulated fishing activities on the high seas. NMFS expects that ICCAT will continue to use trade data to monitor international fishing of Atlantic HMS.

Section 6 References:

Rose, D. 1996. An Overview of World Trade in Sharks. TRAFFIC International. 105 pp.

7. BYCATCH

Bycatch information relevant to each gear type has already been discussed in the appropriate sections. In addition to bycatch of HMS and other species by fishermen targeting HMS, there is the issue of HMS as bycatch in other fisheries as well as the "incidental catch" of marine mammals. The Magnuson-Stevens Act refers only to finfish and turtles as bycatch. As a result, other species such as sea birds and marine mammals are considered "incidental catch." As bycatch tends to occur in fisheries that operate across jurisdictional boundaries, governing bodies, and legal statutes, bycatch reduction often becomes a complex issue.

7.1 Comprehensive Bycatch Reduction Strategy

The NMFS bycatch reduction program includes an evaluation of current data collection programs, implementation of bycatch reduction measures such as gear modifications and time/area closures, and continued research relating to bycatch. Details on bycatch and bycatch reduction measures can be found in Section 3.5 of the HMS FMP.

Bycatch Reporting Methodology

NMFS utilizes self-reported data, observer data, and survey data to produce bycatch estimates. These data are collected with respect to fishing gear type and have been presented by gear type in this report. NMFS compiles bycatch information from the at-sea observer program (longline and gillnet vessels), the pelagic logbook program (commercial shark and swordfish fishermen), and, in the case of recreational bycatch, via dockside and telephone surveys. The number and location of discarded fish are recorded, as is the state of the fish, i.e., alive vs. dead. Post-release mortality of HMS is accounted for in stock assessments to the extent that the data allow. Appendix III contains the forms used for collecting bycatch information, including the observer and logbook forms.

In addition to existing programs in the commercial and recreational HMS fisheries, NMFS implemented a final action in the HMS FMP to place observers on charter/headboat vessels whose owners volunteer for the program (Section 3.8.1). As with charter/headboats, NMFS has the authority to use observers to collect bycatch information from Harpoon, Purse Seine, Angling, and General category vessels fishing for tunas. Before these vessels can be selected for catch, bycatch, and effort reporting, a suitable report form must be developed for these gears. To address this, an analysis of participation in Federal logbook programs coastwide (Northeast, Southeast, and Gulf of Mexico) is being conducted to determine the "gaps" in HMS catch and effort information. Furthermore, the compatibility of logbook programs and forms already in

place is being evaluated to determine if expanding an existing logbook program would meet HMS management needs, or if a completely new program and/or forms are required.

In 1998, Cramer and Adams published the first "Pelagic Longline Bycatch" document which analyzed logbook and observer data to estimate bycatch. This document will be produced annually and used in the SAFE report to evaluate bycatch trends in this fishery. Other species may be added to the list due to ongoing concerns surrounding bycatch mortality in overfished fisheries (e.g., bigeye tuna, yellowfin tuna, bluefin tuna). NMFS collects bycatch data for rod and reel fishermen and uses these data (from LPS) to estimate bluefin tuna dead discards. However, bluefin is the only species for which expanded estimates are currently made. Beginning in 2000 (using 1999 data), NMFS plans to estimate bycatch rates by rod and reel fishermen for other highly migratory species.

Marine Mammals

NMFS relies on both fishery-dependent and fishery-independent data to produce stock assessments for marine mammals in the Atlantic Ocean, Gulf of Mexico, and Caribbean sea. The *draft* stock assessment reports are typically published around January and final reports are published around August. The draft 2000 reports are expected in January, followed by the complementary MMPA List of Fisheries (the draft reports are used to prepare the proposed list of fisheries and the final reports are used in the construction of the final list of fisheries). Generally, the proposed list of fisheries is published in June/July, followed by an MMPA mandated 90-day comment period. The timetable is designed so that the final MMPA list of fisheries can be published by December 1, leaving fishermen ample time to identify those fisheries they must register for before the year begins. However, the final MMPA list of fisheries for 1999 was not yet available at the time of publication of this document.

NMFS continues to investigate serious injuries to marine mammals as they are released from fishing gear. In April 1999, NMFS held a joint meeting of the three regional scientific review groups to further discuss the issue. Although serious injury guidelines have not been published, NMFS will apply the criteria listed by the review groups to make determinations for specific fisheries.

7.2 Bycatch of Highly Migratory Species in Other Fisheries

NMFS is concerned about bycatch mortality of Atlantic HMS in any federal or state-managed fishery which captures them. NMFS plans to address bycatch of these species in the appropriate FMPs. For example, capture of swordfish and tunas incidental to squid trawl operations is to be addressed in the Squid, Mackerel, and Butterfish FMP. Capture rates of tunas in coastal gillnet fisheries are being explored through issuance of exempted fishing permits and reporting requirements. Capture of sharks in trawl, set-net, and hook and line fisheries is being

addressed through cooperative projects with state fishery management agencies and the HMS FMP regulations (some of which are currently under injunction; refer to Section 4.5). NMFS continues to solicit bycatch data on HMS from all state, interjurisdictional, and federal data collection divisions.

Squid Mid-Water Trawl

U.S. squid trawl fishermen landed almost 10 mt of Atlantic HMS in 1998 incidental to the squid, mackerel, and butterfish fishery. These fishermen, using mid-water gear, landed yellowfin tuna, skipjack tuna, albacore tuna, bigeye tuna, and swordfish as incidental catch. Landed fish are counted through the dealer report program and by using information collected from tally sheets. In addition, squid trawl fishermen are required to report landings in the Large Pelagic Logbook or in the Multi-species Logbook. Bycatch of HMS in this fishery is not well-documented. A retention limit of five swordfish per trip allows squid trawl fishermen with swordfish limited access permits to land some of the swordfish that are encountered, although regulatory discards still occur. NMFS continues to work with squid fishermen through the observer program to reduce bycatch.

Table 7.1 **Atlantic HMS Landed Incidental to Squid Trawl Fishing Operations in 1998.** Data based on tally sheets submitted to NMFS.

Species	Amount (mt ww)
Yellowfin tuna	0.7
Skipjack Tuna	0.2
Bigeye Tuna	0.5
Albacore	2.4
Swordfish	5.9
Total	**9.7**

Menhaden Purse Seine

The Gulf of Mexico purse seine fishery for menhaden continues to have substantial bycatch of sharks. Nearly 75percent of the sharks encountered in this fishery died, 97 percent of which were large coastal shark species. An estimated 25,000 large coastal sharks were caught in both 1994 and 1995. Blacktip sharks constituted approximately 35 percent of the total shark bycatch observed in those years (Cortes, 1999). An additional issue associated with the

menhaden fishery is that of sharks "landed" into the machinery of the vessel and ground into fish meal. This mortality will be accounted for in future assessments.

Industry workers in this fishery employ a fish excluder device to reduce the retention of sharks and other large species (Rester and Condrey, 1999). In addition, a recently introduced hose cage modification may prove to be effective in reducing shark bycatch. These devices vary in effectiveness and no standards exist for such bycatch reduction measures in this fishery. In addition, there are currently no reporting requirements for takes of sharks in the menhaden purse seine fishery.

Gulf of Mexico Shrimp Trawl

Shark bycatch in the Gulf of Mexico shrimp trawl fishery consists mainly of sharks too small to be highly valued in the commercial market. As a result, few sharks are retained. The magnitude of this bycatch is not considered in the most recent large coastal shark assessment.

Summary

Although bycatch of swordfish and tunas in the squid trawl fishery is substantial, Atlantic shark bycatch in non-HMS fisheries is a greater concern. Nearly 12 percent (approximately 40,600) of the large coastal sharks accounted for in the 1998 shark evaluation workshop models were bycatch in the menhaden fishery, the longline fishery, and other coastal fisheries in the Gulf of Mexico and South Atlantic. The stock assessment models do not account for shark mortality associated with mid-Atlantic (north of North Carolina) or New England fisheries. Although the HMS FMP requires counting dead discards against Atlantic shark quotas, this management measure is currently under injunction.

7.3 Evaluation of Bycatch Reduction Measures

- Reduce length of longline to increase survival of mammals:

  NMFS is not able to evaluate the effectiveness of this measure at this time as the data have not yet been prepared for analysis.

- Close area in June to decrease bluefin tuna bycatch:

  NMFS is not able to evaluate the effectiveness of this measure at this time as the data have not yet been prepared for analysis.

- Atlantic Large Whale Take Reduction Plan (ALWTRP) regulations:

Observers were placed on shark drift gillnet vessels during right whale season off the East Coast of Florida between Fort Pierce and West Palm Beach (Carlson and Lee, 1999) and covered 91.3percent of the sets made during right whale season. Twenty drift gillnet sets were observed. Four marine mammals (bottlenose dolphin) were observed caught and discarded dead. No large whales were encountered by this gear during right whale season (January 8 - March 31, 1999).

- MMPA List of Fisheries Update/Stock Assessment:

  NMFS continues to update the MMPA List of Fisheries and the proposed list is expected to be available to the public in June/July of 2000. The list will be based on updated stock assessments of marine mammals.

- Meeting of the Atlantic Offshore Cetacean Take Reduction Team (AOCTRT)/Future Plans:

  NMFS Office of Protected Resources hopes to reconvene the AOCTRT in 2000 to review new data for the pelagic longline fishery and to discuss the need for additional take reduction measures outside of those already being implemented under the HMS FMP.

- Observer coverage of shark gillnet fleet:

  Due to the high costs of this observer program and limited funding, NMFS is exploring other options for observer coverage in this fishery including state-federal cooperation.

7.4 Recommendations to Reduce Bycatch

In 1998, NMFS published a National Bycatch Plan (NOAA, 1998). The plan recommended numerous actions to address bycatch mortality. Table 7.2 lists the recommendations and actions taken by NMFS thus far to address these issues.

Table 7.2 Recommendations for Addressing Bycatch Mortality in HMS Fisheries and Actions Planned or Taken to Address These Recommendations.

Recommendation	Action
Improve data on the character and magnitude of bycatch to allow quantitative estimates of discards in the fisheries for use in stock assessments and making management decisions.	Pursued submission of bycatch data by ICCAT countries for analyses to develop measures to reduce small swordfish bycatch stock-wide.
Improve gear-handling techniques to reduce mortality.	Educational workshops for recreational and commercial fishermen.
Conduct research on gear-deployment methods that will reduce interactions between and mortality of protected species that encounter fishing gear.	NMFS funded research includes: • A circle hook study in the Azores, FY 98 • Development of a line cutter that would decrease injuries to turtles, FY 98 Hoey and Moore (1999) report provides suggestions for gear modifications.
Work cooperatively with the fishing industry to transfer new knowledge and techniques between fishermen and researchers.	Educational workshops include research results on the agenda.
Reduce bycatch and bycatch mortality of undersized swordfish and tunas.	Swordfish are addressed in proposed time/area closures in the South Atlantic Bight and Gulf of Mexico; final rule is expected in 2000. Educational workshops for recreational fishermen.
Improve knowledge of (1) basic biology and stock status of shark species in the Northwest Atlantic and (2) the effects of bycatch mortality on shark populations.	NMFS funded research includes: • Center for shark research at Mote Marine Lab: shark biology, FY98 • Univ of MI: shark nursery grounds, FY98 • Gulf and South Atlantic Fishery Development Foundation: observer program and biology, FY98 • COASTSPAN: a study to identify shark nursery areas, FY 98 • Participation in pelagic shark assessment in February, 2000. NMFS is in the process of constructing a National Plan of Action for Sharks commensurate with the FAO International Plan of Action for Sharks to assess direct and indirect shark fisheries, stock status, and promote more effective and sustainable shark management.
Increase research on the role of apex predators in structuring marine ecosystems, and assess the effects of bycatch of these stocks.	NMFS funds COASTSPAN, a study to identify shark nursery areas.
Reduce mortality and bycatch mortality of billfish captured in the directed fisheries for Atlantic HMS.	Proposed time/area closures in the South Atlantic Bight and Gulf of Mexico; final rule expected in 2000

Recommendation	Action
Determine the status of sailfish populations.	Assessment to be conducted by SCRS at ICCAT in 2001*
Conduct research on post-release mortality of recreationally-caught billfish, tunas, and sharks.	Research being funded by NMFS includes: • MA Div. Marine Fisheries: Effects of Hook Design, FY98 • Bluefin tuna tagging Sponsored Catch and Release Conference in Nov. 1999 to share data on this topic, identify further research needs
Improve data collection and monitoring of the recreational tuna, shark, and billfish fisheries.	New voluntary Charter/Headboat observer program and logbook program Increased tournament registration and reporting.

* Because stock assessments are conducted internationally by SCRS, NMFS does not produce domestic stock assessments for ICCAT species. However, NMFS has developed overfishing criteria based on the most recent assessment (1993) and has determined that West Atlantic sailfish are overfished and overfishing continues to occur.

7.5 Summary

It is difficult to compare fishing gears due to the differences in areas and seasons fished. However, Table 7.3 gives a summary of the percent bycatch (by number of fish) for each HMS fishing gear where data were available. Table 7.4 summarizes the total percentage of mortality attributed to bycatch for Atlantic HMS.

Table 7.3 **Percent of Total Finfish Catch as Bycatch in HMS Fisheries:** Based on Number of finfish discarded/Number of total finfish caught*

Gear	Time Period	Percent Bycatch (by number of fish)	Source
Shark Drift Gillnet	June-July 1999	37 %	NMFS observer data
Pelagic Longline	Jan-Dec. 1998	58.3%	NMFS observer data
Bottom Longline	Jan.-June 1998 July-Dec 1997	7% 28%	GSAFDF observer data
Purse Seine	August 1996	19% (by weight)	NMFS observer data

* It should be noted that observer coverage is limited in many HMS fisheries. Therefore, these bycatch rates are general estimates, that should be used only for comparison purposes. Particularly in the pelagic longline fishery, observer coverage does not reflect proportionally the number of sets made in each sampling area.

Table 7.4 **Percent of Stock-Wide Mortality Attributed to Bycatch for HMS Stocks in 1998*.** Sources: SCRS, 1999; Cortes, 1999 (sharks only).

Species/Stock	Percent of Mortality Attributed to Bycatch
North Atlantic Swordfish	4% (by weight)
South Atlantic Swordfish	less than 0.1%
West Atlantic Bluefin Tuna	3.1%
Large Coastal Sharks	12% (by number)
Pelagic Sharks**	27% (by weight)
Small Coastal Sharks***	Unknown
Blue Marlin	4%
White marlin	6.7%
Sailfish	1.8% (by weight)
Spearfish	0%

*Based on the landings and discards reported to ICCAT for stocks fished on by U.S. fishermen. It should be noted that the United States does not report discards of BAYS tunas to ICCAT.

**Pelagic shark estimates are from 1997 and can be found in Section 2.4.3 of the HMS FMP. Of the estimated 27%, 19% is attributable to blue shark dead discards.

***1997 observer data indicated that 98%, 81%, and 28% of small coastal shark landings in the North Carolina, west Florida, and south Atlantic Bight regions, respectively, were used for bait rather than landed. Due to unreported mortality of small coastal sharks caught in other fisheries and the disparity in reporting bait fish, there is insufficient information to provide a summary number. Atlantic shark numbers are higher than those for other

species partly because all data sets are from the United States where minimum sizes and no retention provisions are enforced.

In Table 3.47 of the HMS FMP, NMFS identified the significance of bycatch of certain species in various HMS fisheries. Table 7.5 below indicates action NMFS has taken to address those issues and reduce bycatch.

Table 7.5 Addressing Significant Bycatch Concerns in HMS Fisheries

Gear	Significant Bycatch Species	Action Planned or Taken
Pelagic Longline	• bluefin tuna • undersized target species • mammals • sea turtles	• Closed area in Mid-Atlantic bight in June • Proposed rule to close South Atlantic Bight area year-round, Gulf of Mexico area March - September. • Gear modifications, educational workshops • Move after one entanglement.
Bottom Longline	• undersized target • prohibited shark species	**Note**: Due to a court injunction, minimum sizes are no longer in effect in the commercial fishery.
Shark Gillnet	• undersized target • protected species • prohibited shark species	• Observer coverage to collect necessary data

Section 7 References:

Carlson, J. and D. Lee. Catch and Bycatch in the Shark Drift Gillnet Fishery off East Florida During the Critical Right Whale Season, 1999. Sustainable Fisheries Division Contribution SFD-98/99-60.

Cortes, E. 1999. 1999 Shark Evaluation Annual Report. Sustainable Fisheries Division Contribution SFD-98/99-64.

Hoey, J and N. Moore. 1999. Captain's Report: Multi-Species Characteristics for the U.S. Atlantic Pelagic Longline Fishery, August 1999. 78 pp.

NOAA. 1998. Managing the Nation's Bycatch: Programs, Activities, and Recommendations for the National Marine Fisheries Service. 174 pp.

Rester, J.K. and R.E. Condrey. 1999. Characterization and Evaluation of Bycatch Reduction Devices in the Gulf Menhaden Fishery, North American Journal of Fisheries Management. 19: 42-50.

SCRS. 1999. Report of the Standing Committee on Research and Statistics, ICCAT SCRS, October 11-15, 1999. 168 pp.

8. LIMITED ACCESS & PERMITTING

One major concern in the management of HMS commercial fisheries is overcapitalization. As many HMS species are overfished (see Table 2.1), allocation of the resource becomes a difficult and contentious issue. Limited access and permitting mechanisms are ways of addressing the "too many fishermen chasing too few fish" dilemma that faces many of the world's fish stocks. To date, HMS has responded to overcapitalization issues through a variety of methods in addition to limited access to swordfish, shark, or tuna longline permits. Individual Vessel Quotas (IVQs) for bluefin tuna purse seiners were implemented in 1982 (described in Section 4.2.1 of this report) to exclude new entrants into the fishery. In 1995, NMFS published a final rule (64 FR 38505, July 27, 1995) that limited purse seiner access to BAYS fisheries. Three workshops were held in late 1995/early 1996 to discuss limited access in all Atlantic tunas fisheries. In addition, NMFS published a concept paper on limited access for Atlantic HMS (NMFS, 1995a) and established a control date (September 1, 1994), published in the *Federal Register,* after which new vessels entering the fishery are not guaranteed future access to Atlantic tuna fisheries (59 FR 45262, September 1, 1994).

Overcapitalization issues continue to affect charter/headboat vessels as well. The Gulf of Mexico Fishery Management Council is currently considering implementation of a temporary moratorium on the issuance of charter/headboat vessel permits. The preferred alternatives include a control date of September 16, 1999, beyond which a permit holder is no longer assured access to the fishery. In order to prevent spillover into HMS fisheries, an ANPR control date for HMS charter/headboats may be considered in the future.

8.1 Limited Access

8.1.1 Overview of Measures Established in the HMS FMP

Overcapitalization and open access fisheries are associated with many problems, including derby fisheries, market gluts, poor product quality, safety concerns, and loss of market niches due to shortened fishing seasons and reliance on imported fish. Accordingly, the HMS FMP outlined several objectives that specifically relate to rationalization of HMS fisheries through a limited access program implemented in July 1999, including:

- To minimize, to the extent practicable, economic displacement and other adverse impacts on fishing communities during the transition from overfished fisheries to healthy ones.

- Consistent with other objectives of this FMP, to manage Atlantic HMS fisheries for continuing optimum yield so as to provide the greatest overall benefit to the Nation,

particularly with respect to food production, providing recreational opportunities, preserving traditional fisheries, and taking into account the protection of marine ecosystems.

- To reduce latent effort and overcapitalization in HMS commercial fisheries.

- To develop eligibility criteria for participation in the commercial shark and swordfish fisheries based on historical participation, including access for traditional swordfish handgear fishermen to participate fully as the stock recovers.

- To create a management system to make fleet capacity commensurate with resource status so as to achieve the dual goals of economic efficiency and biological conservation.

As stated in the HMS FMP, the goal of this **first step** of limited access in the Atlantic swordfish, shark, and tuna longline fisheries is **to begin to** rationalize current harvesting capacity with the available quota and reduce latent effort without significantly affecting the livelihoods of those who are substantially dependent on the fisheries (in other words, to prevent further overcapitalization).

The final eligibility criteria, which are based on current and historical participation, are summarized in Table 8.1.

Table 8.1 Limited Access Eligibility Criteria*

Fishery	Historical Permit Time Frame	Directed Permit Landings Threshold	Incidental Permit Landings Threshold	Recent Permit Time Frame
Swordfish	June 30, 1994 to Dec. 31, 1997	25 swordfish, or at least $5,000 gross revenue from sales of swordfish, per year in any 2 years between 1987 and 1997	11 swordfish total from 1987 to 1997 and meeting the minimum earned income requirement*	June 1, 1998 to Nov. 30, 1998
Shark	June 30, 1994 to Dec. 31, 1997	102 sharks, or at least $5,000 gross revenue from sales of sharks, per year in any 2 years between 1991 and 1997	7 sharks total from 1991 to 1997	Jan. 1, 1998 to Dec. 31, 1998
Tuna Longline	NA	NA	NA	Jan. 1, 1998 to Dec. 31, 1998
Swordfish Handgear	Must provide documentation of (1) having been issued a swordfish permit for use with harpoon gear or (2) having landed swordfish with handgear as evidenced by logbook records, verifiable sales slips or receipts from registered dealers, or state landings records. Permits also will be issued to fishermen who meet the minimum earned income requirement.**			

*Two exemptions provided for persons that acquired ownership of a vessel and its landings history after December 31, 1997, and for persons that first obtained a shark or swordfish permit in 1997.

**The minimum earned income requirement states that owners must provide documentation that more than 50 percent of their earned income from commercial fishing came through the harvest and first sale of fish or from charter/headboat fishing, or at least $20,000 gross revenue from commercial fishing, during 1 of the last 3 calendar years.

In addition to issuance of limited access permits, NMFS implemented the requirement that three limited access permits (at least incidental swordfish, at least incidental shark, and Incidental/Longline category tuna) were required to participate in the Atlantic swordfish fishery (except the swordfish handgear fishery) and the Atlantic tunas longline fishery.

In May, 1999, NMFS mailed permits to 796 vessel owners that met the final eligibility criteria, based on permit and landings records (203 directed swordfish, 218 incidental swordfish, 213 directed shark, 583 incidental shark, and 421 tuna Incidental/Longline limited access permits). As of December 30, 1999, NMFS had received approximately 580 applications, 386 of which resulted in initial approval for a directed or incidental limited access permit. Between the permits issued in May and successful applications (as of December 30, 1999), a total of 976 vessel owners have been issued limited access. Approximately 243 directed swordfish, 208 incidental swordfish, and 114 swordfish handgear limited access permits have been issued. Approximately 279 directed shark and 599 incidental shark limited access permits have been issued.

Approximately 451 tuna longline limited access permits have been issued. The distribution of limited access permits by state is below:

Table 8.2 **Distribution of Limited Access Permits**: Based on the number of qualifying permit holders as of December 30, 1999.

State	# Directed Swordfish	# Incidental Swordfish	# Swordfish Handgear	# Directed Shark	# Incidental Shark	# Tuna Longline	TOTAL (# Permit Holders/# Permits)
ME	4	8	7	5	21	12	33/57
NH	-	1	1	1	5	1	7/9
MA	12	10	30	2	24	22	55/99
RI	9	7	27	1	19	16	44/79
CT	1	2	1	-	3	3	4/10
NY	22	12	12	11	30	34	51/121
NJ	34	30	14	36	47	64	95/225
DE	2	1	-	2	2	3	4/10
MD	8	3	-	2	10	11	12/34
VA	3	9	-	5	12	12	17/41
NC	10	41	5	23	56	51	83/186
SC	5	1	-	7	16	6	23/35
GA	-	1	-	2	5	1	7/9
FL	85	47	17	166	237	132	413/683
AL	2	3	-	1	6	5	7/17
MS	-	2	-	2	9	2	11/15
LA	35	16	-	7	64	51	71/173
TX	8	13	-	6	29	21	35/77
CA	1	1	-	-	2	2	2/6
VI	2	-	-	-	2	2	2/6
TOTAL	243	208	114	279	599	451	976/1892

Of the approximately 155 applications that were denied, 56 permit holders have appealed that decision. Appeals have been submitted on the basis of the submission of additional materials,

that the original application materials were incorrectly reviewed, and that hardship prevented meeting the eligibility criteria. As of January 18, 2000, 9 of the 21 appeals that have been issued final decisions have been approved and the requested permit issued.

8.1.2 Review of Relative Success

In order to review the success of the limited access program, it is important to evaluate the results in the context of the original objectives. Constituent comments raised during the limited access application process have included the issue of fleet stability, the potential for increased captain and crew participation (versus vessel owners only), and the concern that there are still too many permit holders in the swordfish, shark, and tuna longline fisheries. As emphasized in the HMS FMP, the current limited access system is only a first step. Based on the relative success of the system in place, additional steps may be taken to address overcapitalization. NMFS continues to solicit constituent comments on limited access and plans to discuss the matter with members of the HMS AP at the February 2000 meeting.

Possible future management measures:

- No further reduction (status quo) in the number of limited access permits.
- Attrition/Use or lose - reduce the number of permits based on non-renewal or lack of landings.
- Two-for-One entry - require entrants to the fishery to transfer two permits in order to obtain one limited access permit.
- Non-transferable Individual Fishing Quotas (IFQs).
- Individual Transferable Quota (ITQ) systems including landings based, auction, and/or lottery allocation.
- Permit buybacks.

Points to consider when developing future management measures (from the National Research Council report on IFQs):

- Is there broad stakeholder support and participation?
- Is the fishery amenable to cost-effective monitoring and enforcement?
- Are there adequate data, particularly concerning the socioeconomic effects of an IFQ? If not, what is needed?
- Is Federal-state cooperative management for sharks required before an ITQ program could be truly effective?

Trade-offs of implementing additional management measures:

- Increased economic efficiency may result in decreased employment.
- Decreased ability for young people without substantial capital to enter the fishery.
- Longer seasons promoting decreased derby conditions.
- Increased stability in the fishery, markets, and availability of fresh product for the public.
- Privatization of public resource and the creation of an expectation that allocation is a "right".
- Potential windfall if initial allocation is "gifted" (possibly reduced through fees or taxes).
- Bycatch reduction.

Types of possible future permits:

- Gear-based; specific permits for longline, gillnets, and handgear.
- Permits with specific trip limits; i.e, "directed longline" would allow unlimited tuna, sword, shark (except large coastal sharks); incidental longline would allow a limited number of tunas, swordfish, and sharks (as opposed to species-based permits with the requirement to carry several permits).
- Recreational permits.

8.1.3 Upgrading & Safety Issues

NMFS has received comments that the vessel upgrading restrictions on length overall (LOA), gross and net tonnage, and horse power are not appropriate for primarily longline fisheries, are not the preferred vessel characteristics to limit overcapitalization, and have substantial safety at sea concerns. Hold capacity was identified by constituents as a preferred vessel characteristic that would not impact safety at sea and would meet the objective of addressing overcapitalization in HMS commercial fisheries. NMFS did not implement hold capacity as a measure to limit vessel upgrading due to the lack of standard measurements of vessel hold capacity as well as the lack of consistent collection of this information for HMS commercial vessels as part of existing vessel registration systems.

Options to address upgrading:

- Maintain the status quo; no more than a 10 percent increase in LOA, gross registered tonnage, and net tonnage, and no more than a 20 percent increase in horse power from baseline allowed.
- Adjust hold capacity in addition to, or instead of, LOA and gross registered tonnage.
- Allow a greater percentage increase from baseline.

- Create vessel categories of <30', 30-49', 50'-69', >70' (from Larkin, 1998) and allow upgrading either within a category, but not across categories, or upgrading across categories only once.

Trade-offs of upgrading adjustments:

- Upgrading restrictions wouldn't be consistent with the New England Fishery Management Council and Mid-Atlantic Fishery Management Council regulations; vessels that participate in multiple fisheries under several jurisdictions may be in "regulatory box".
- Potential increases in fleet overcapitalization.
- Increased safety at sea and increased ability to fish further offshore (due to time/area closures, minimum sizes).

8.1.4 Individual Fishing Quotas

* The following information is summarized from the National Research Council (NRC) report *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas*.

An individual fishing quota (IFQ) is a system of allocating harvesting quota to individual fishers. As defined in the Magnuson Stevens Act, an IFQ is "a Federal permit under a limited access system to harvest a quantity of fish, expressed by a unit or units representing a percentage of the total allowable catch of a fishery that may be received or held for exclusive use by a person" (MSFCMA, Sec. 3[21]). The Sustainable Fisheries Act of 1996 established a moratorium on new IFQ programs through October 1, 2000 and required the National Academy of Sciences through the NRC to prepare a comprehensive review addressing concerns on the social, economic, and biological consequences of IFQ's and limited entry systems.

The NRC committee responded in the recently published report *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas.* The recommendations and conclusions were based on an analysis of IFQ programs already in place in the United States and abroad, witness testimony, and additional written material submitted to the NRC committee.

IFQ programs have proven to be a highly effective way of reducing overcapitalization in a fishery. They create economic incentives for vessel owners to decrease labor and capital inputs and may have positive secondary effects including bycatch reduction and greater levels of efficiency and safety. The largest concerns generated from an IFQ system relate to equity issues including the fairness of initial allocations, transferability, accumulation of shares, and the potential increased cost of new entry into the fishery.

The committee recommends that Congress lift the moratorium on the development and implementation of IFQ programs set in the 1996 Sustainable Fisheries Act. On the whole, the committee felt that decisions regarding IFQ's are best made at the regional and council level and on a fishery-by-fishery basis. There is no "one-size-fits-all" IFQ program. *Sharing the Fish* provides recommendations for various levels of fishery management and highlights what have been some of the more contentious issues with previous IFQ systems. A summary of those findings and recommendations is provided below with particular emphasis on their application to HMS fisheries.

When to consider use of an IFQ:

- There is a precedence of some other intermediate limiting mechanism, such as a license moratorium or limited access system.
- Prior Total Allowable Catches (TAC's) have led to shortened seasons, increased competition, safety concerns, and restructuring of historical socioeconomic dynamics.

Prior conditions favorable to IFQ implementation:

- The TAC can be specified with reasonable certainty.
- Improving economic efficiency, reducing the number of firms, vessels, and/or people are high priority goals.
- There exists broad stakeholder support and participation.
- The fishery is amenable to cost-effective monitoring and enforcement
- There are adequate data, particularly concerning the socioeconomic effects of an IFQ.
- Provisions have been made to address any spillover into other fisheries.

Key components to address in IFQ development:

- Initial allocation and qualifications for holding.
- IFQ program development process.
- Nature and duration of an IFQ.
- Transferability and accumulation.
- Monitoring and enforcement.
- Cost recovery for administration.

Observed outcomes of previous and current IFQ programs:

- Reduced vessels participating in the fishery.

- Longer fishing season and an occasional increase in ex-vessel prices.
- Generally less incentive to fish in unsafe conditions.
- Decrease in total harvest-sector employment.
- Potential aggregation of IFQ's prior to program implementation.

Lessons learned from other IFQ programs:

- IFQ's have different effects in different fisheries.
- The objectives of an IFQ system must be clearly defined before program development and implementation.
- Success depends on other management provisions already in place, such as TAC.
- Trade-offs need to be clearly identified (i.e., more economic efficiency for less participation).
- Constituents must be broadly involved in all phases.
- There is potential for secondary effects including reduced ghost fishing, reduced derby fishing, greater incentive for participants to conserve the resource, and different methods of data collection that lead to revised monitoring methods and TAC levels.

Caveats specific to HMS management:

- An IFQ (or any other management measure) needs to encompass the entire stock (consistent with NS 3) or else the "unmanaged" portion may become over exploited. This is most likely when stocks range across state-federal boundaries, boundaries between nations, or into high seas as in HMS fisheries.
- The NRC committee recommended community based governance, and/or co-management approaches. While these may have been feasible in small scale fisheries, their implementation in HMS fisheries may be difficult due to the varied life histories and migratory nature of the resource as well as the wide geographic range of participants.

Initial Allocation and Transferability

The issues of initial allocation and transferability are important enough to merit individual discussion. Every previous IFQ system has allocated portions of the quota based on historical catch levels. The committee stressed that this is but one way of determining an equitable method to distribute shares. They cited three factors responsible for the controversy: "windfall" profit to initial recipients, criteria for allocation, and the number of shares received. Different methods including lotteries (random allocation), auctions (market driven allocation), and catch based (procedural allocation) were discussed. While the committee favored no one approach, they encouraged exploring the use of different options rather than relying on typical landings based distributions. Specific recommendations on allocation and transferability include the following:

- Consider a wide range of initial allocation strategies addressing who, how many should be allocated, and how much should be charged.
- Consider a broad range of criteria for determining participation and initial shares (more than catch history).
- Include crew and skippers (versus only vessel owners) in initial quota distributions where appropriate.
- Include communities in initial IFQ allocation where appropriate.
- Consider auctions and lotteries to allocate initial share as opposed to just "gifting" them.
- Transferability should be decided at a regional level based on specific IFQ goals
- Leasing and permanent transfer should generally be allowed, but may be restricted on a case by case basis to prevent absentee ownership.

Inherent in the Magnuson-Stevens Act's requirements for an NRC assessment was the establishment of two independent advisory groups to assist in report preparation. One of the responsibilities of the advisory panel was to prepare a "report on the report" and provide opinions on the NRC document. The final report was published in May 1999, and included comments from 8 of the 28 advisory panel members. The report highlights some of the varying approaches to IFQ management, but generally supports the NRC and their recommendations and conclusions. Due to the limited input and overall agreement with *Sharing the Fish*, no further discussion on the report is included at this point.

An IFQ discussion has specific relevance to HMS management in the next several years, provided the Congressional moratorium is lifted. The majority of previous IFQ's have been implemented in limited access situations. HMS continues to closely monitor and supervise the limited access system for Atlantic swordfish, sharks, tunas established in the 1999 Fishery Management Plan. Based on the committee's recommendations, an IFQ system may be one alternative considered as a future management measure.

8.2 Permitting Issues

8.2.1 Dealer Permits

To this point, permits have been discussed on a case-by-case basis. Dealer permits are required for commercial receipt of Atlantic tuna, swordfish, and sharks, and are detailed in Section 2.6.1 of the HMS FMP. The appropriate dealer permits are necessary for those importing bluefin tuna and/or swordfish from any ocean, the specifics of which are discussed in Sections 6.3.1 and 6.3.2 of this report. All dealer permit holders are required to submit reports detailing the nature of their business. For swordfish and shark permit holders (including those who *only* import swordfish), dealers must submit bi-weekly dealer reports on all HMS they purchase. Tuna dealers must submit, within 24 hours of the receipt of a bluefin tuna, a landing report for each bluefin purchased from a U.S. fishermen. Dealers must also submit bi-weekly reports that include

additional information on tunas they purchase. Negative reports are required when no purchases are made to facilitate quota monitoring (i.e., NMFS can determine who hasn't purchased fish versus who has neglected to report). NMFS continues to automate and improve its permitting and dealer reporting systems and plans to make additional permit applications and renewals available online in the near future.

8.2.2 Atlantic Tuna Permits

Based on feedback from permit holders, NMFS has made improvements to all aspects of the Atlantic tunas permitting and recreational bluefin tuna landings reporting system. NMFS has contracted with AppNet, Inc. to issue Atlantic tunas permits starting in 2000. These permits, made available December 1, 1999, allow vessels to fish for Atlantic bluefin, yellowfin, skipjack, albacore, and bigeye tunas. All permits issued in 1999 expired on December 31, 1999. Current permit holders were mailed renewal instructions in early November 1999.

Vessel owners may renew or obtain an initial (new) permit by using the Internet (www.nmfspermits.com) or phoning (888) 872-8862 (toll-free) and using the automated system or speaking to a Customer Service agent. Note that this new website should be accessed instead of the old www.usatuna.com website, but that the toll-free phone number remains the same. The fee for new permits and renewals is $25, payable by credit card or money order. To determine the permit fee, NMFS prepared a product cost computation per NOAA Finance guidance. In the computation, the costs incurred in supplying permits (private contract costs, plus NOAA/NMFS employee time, computer support, and necessary travel expenses) were totaled and then divided by the number of units (permits) issued. Vessel owners can receive their Atlantic tunas permit by printing it off the Internet following approval of their application, or by fax, Priority mail, or First Class mail. Recreational tuna permit are required to report their recreational landings of bluefin tuna and, as of December 1999, may now do so via the website or phone system.

In the HMS FMP, NMFS changed the fishing year for Atlantic tunas to June through May of the following year in order to facilitate timely implementation of international fishery recommendations. Therefore, Atlantic tunas permits issued in 2000 will be valid from the date of issuance through May 31, 2001. The Atlantic tunas permit will then be renewable on an annual (fishing year) basis.

The HMS FMP implements a new requirement that owners of charter boats or headboats that are used to fish for, take, retain, or possess Atlantic tunas, sharks, swordfish, or billfish must obtain a Highly Migratory Species Charter/Headboat permit. This new permit will replace the current Atlantic tunas Charter/Headboat permit. This requirement will be effective once the Office of Management and Budget approves the new class of permit. An Atlantic tunas Charter/Headboat permit will be valid for use as an HMS Charter/Headboat permit until its expiration date of May 31, 2001.

8.2.3 Charter/Headboat Vessels

Since publication of the Consolidated Rule on May 28, 1999, several steps have been taken towards implementing HMS permits and logbooks for charter/headboat vessels. Existing state and federal charter/headboat permits and their associated reporting requirements were reviewed to identify potential respondents. An inventory of vessels with Atlantic tunas charter/headboat permits that are currently obligated to report under non-HMS fisheries regulations in other programs was also conducted. NMFS is currently preparing documents required by the Paperwork Reduction Act to be submitted to the Office of Management and Budget for approval. An Issues/Options paper articulating the full range of alternatives to address new charter/headboat reporting requirements, as well as expanding tuna reporting requirements, is also being prepared. An operational plan detailing who will be selected, to what regions they will report, and what forms will be used will then be prepared.

Development of the voluntary observer program for the charter/headboat sector will be initiated once HMS charter/headboat permits have been implemented. As noted in the FMP amendment, the degree of implementation is subject to the number of fishermen who volunteer to participate as well as the availability of funds.

Section 8 References:

Committee to Review Individual Fishing Quotas, National Research Council. 1999. "Sharing the Fish: Toward a National Policy on Individual Fishing Quotas". National Academy Press.

NMFS. 1995. Towards Rationalization of Fisheries for Atlantic Highly Migratory Species. July, 1995. Silver Spring, MD.

NMFS. 1999. National Marine Fisheries Service's IFQ Advisory Panel Report on the National Research Council Report "Sharing the Fish: Toward a National Policy on Individual Fishing Quotas".

9. ISSUES FOR CONSIDERATION

Since the publication of the HMS FMP, issues requiring additional management have surfaced. While some have already been proposed as new rules, others will be addressed at the next round of the HMS Advisory Panel meetings. This section overviews some of the challenges resulting from implementation of the HMS FMP measures, the regulatory framework in which they are defined, and regulatory issues addressed after the HMS FMP.

9.1 Overview of Measures Established in the HMS FMP

Final regulations to implement the HMS FMP and the Billfish Amendment were published in the Federal Register on May 28, 1999 (64 FR 29090). This final rule not only implemented the new management regulations developed under the FMPs, but also consolidated into one new part of the Code of Federal Regulations (CFR), namely 50 CFR part 635 -- Atlantic Highly Migratory Species, all of the existing regulations previously issued for Atlantic tunas (50 CFR part 285), Atlantic swordfish (50 CFR part 630), Atlantic billfish (50 CFR part 644) and Atlantic sharks (50 CFR part 678). The consolidation was in response to the President's Regulatory Reinvention Initiative.

In developing the FMPs, new management measures were needed to implement the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and the recommendations of the International Commission for the Conservation of Atlantic Tunas (ICCAT) as required by the Atlantic Tunas Convention Act (ATCA). Generally, these new management measures include quotas, size and retention limits, prohibited species, time-area closures, vessel/dealer permits and reports, and effort controls as needed to rebuild overfished stocks, reduce bycatch as a source of mortality and address other legislative requirements. Other substantive changes to the regulations were needed to achieve consistency within the context of the regulatory consolidation. More detailed summaries of the new management measures can be found in the executive summaries of the HMS FMP and the Billfish Amendment.

9.2 Technical Amendments

Shortly after publication of the consolidated final rule to implement the FMPs, a technical amendment was issued (64 FR 37700, July 13, 1999) to correct and clarify provisions of the regulations. The technical amendments were needed to clarify the applicability of recreational retention limits to persons aboard charter/headboat vessels; to set Atlantic bluefin tuna (BFT) quotas for the period beginning January 1, 1999, and ending May 31, 1999; to clarify the requirements for embarking observers aboard shark gillnet vessels; to reestablish certain

enforcement provisions inadvertently edited from the consolidated HMS regulations; to clarify transfer provisions for limited access permits; to correct the baseline reference point for limited access fishery vessel upgrades; to clarify references to the management unit and jurisdictional areas for species under regulation by the International Commission for the Conservation of Atlantic Tunas (ICCAT); to correct the effective dates of the restriction on length of pelagic longlines; to correct cross references; and to remove the interim provisions that were not intended to remain in effect beyond June 30, 1999.

9.3 Issues for Framework Regulatory Amendment

Since the final regulations were issued, several constituent groups have raised questions about interpretations of the regulations, especially in cases where certain activities now prohibited under the consolidated regulations were previously authorized when the regulations were published in separate parts of the CFR. In other cases, constituents have raised concerns that the consolidation caused substantive changes to authorized activities, or created situations where the applicability of restrictions or requirements was broadened, that were not clearly communicated in the preamble to the proposed rule or adequately explained during public hearings. Finally, several lawsuits were filed against the Secretary of Commerce relative to implementation of the FMPs.

NMFS has addressed, or plans to address, some of these issues under the framework provisions of the HMS fishery management plan (FMP). The framework adjustment process involves publication of a proposed rule and an opportunity for public comment. Such provisions for public input may involve convening a meeting of the Advisory Panel(s). The removal of the purse seine cap (64 FR 58793, November 1, 1999), discussed in Section 4.2.1, and the proposed time/area closures for pelagic longline gear (64 FR 69982, December 15, 1999), discussed in Section 4.1.6, were framework adjustments introduced in 1999 and addressed at a June 1999 joint HMS and Billfish Advisory Panel meeting.

NMFS will work towards implementing the 1999 ICCAT recommendations in an upcoming proposed rule. The rule will include measures to establish the 2000, 2001, and 2002 North Atlantic swordfish quotas and a dead discard allowance for each of those three years. The proposed rule will also include a proposal to prohibit the import of swordfish from Honduras and Belize, prohibit the import of bluefin tuna from Equatorial Guinea and eliminate the existing trade restriction for bluefin tuna from Panama.

Other issues raised for which NMFS may propose to amend the consolidated regulations include: adjustment of the boundary line for the north-south division of the BFT Angling category; respecification of authorized gear, permitting requirements and fishing years in the respective HMS fisheries; prohibition of the retention of Atlantic billfish on board any vessel issued a commercial category permit for any Atlantic HMS; revision of the requirements for dealer permitting and reporting for HMS purchases and imports; specification of installation procedures for vessel monitoring systems; adjustment of the regulations pertaining to

charter/headboat operations relative to sale of fish, applicability of retention limits and the requirements for licensed captains on board; revisions to the requirements for observers on board shark drift gillnet vessels; revision of the requirements for vessel upgrading and permit transfer for vessels issued limited access permits; prohibiting removal of shark fins at sea; and revision of certain portions of the regulatory text to facilitate enforcement. Some or all of these measures may be addressed in a "Miscellaneous Rule." Expected published rules in early 2000 include the Miscellaneous Rule, the 1999 ICCAT recommendations rule, and the final time/area closure rule.

9.4 Issues for FMP Amendment

The other primary method that can be used to change management measures included in an FMP is an FMP amendment, required when the proposed action will have a significant impact on the environment or would change the fundamental approach to management. The Outlook Section (Section 10) of this report identifies problem areas in current management and issues to discuss with the Advisory Panel and constituents. Some of these issues may be significant enough to require an eventual FMP amendment.

9.5 Additional Issues

Late in the fall 1999 session, four separate bills were introduced to address the issues of bycatch mortality and overfishing in HMS fisheries. Three of the four bills (S 1991, introduced by Sen. John Breaux (D-LA); HR 3390, an identical companion bill introduced by Rep. Goss (R-FL); and HR 3331, introduced by Rep. Jim Saxton (R-NJ)) focus on reduction of billfish bycatch and the catch of undersize swordfish through measures similar to that in NMFS' time area rule (64 FR 69982, December 15, 1999). Although the above bills were constructed with input from the Billfish Foundation, the Coastal Conservation Association, the American Sportfishing Association and the Blue Water Fishermen's Association, they do contain different language. The fourth bill, HR 3516 introduced by Rep. Sanford (R-SC), prohibits "pelagic longline fishing in the exclusive economic zone in the Atlantic Ocean." The bill provisions mentioned here can be expected to change as the proposed pieces of legislation move through the legislative process and incorporate more constituent feedback.

S 1991 and HR 3390 are identical and consist of a three point plan involving time/area closures, a buyout program, and additional research. As introduced in the Senate on November 10, 1999, and in the House on November 16, 1999 the bill:

- Establishes a permanent year-round closure to pelagic permanent year-round closure to pelagic longline fishing in the South Atlantic from the North Carolina/South Carolina ocean boundary to Key West, Florida.
  Establishes two seasonal closures in the Gulf of Mexico: A permanent closure in the Northeastern Gulf of Mexico from January 1st to Memorial Day each year; a temporary 5-

year closure from the Texas/Mexico ocean boundary to the Florida Panhandle that will be closed from Memorial Day to Labor Day of each year for five years.

- Provides a longline permit voluntary buyout program for 68 longline commercial vessels "through a partnership of the recreational and commercial fishing industries and federal funds." All vessels that participate in the program would have to surrender all commercial fishing permits.
- Directs the National Marine Fisheries Service to conduct a research program to identify and test the most effective fishing gear configurations in reducing the billfish bycatch in the Atlantic and Gulf of Mexico.

HR 3331 is similar, but the version introduced in the House on November 10, 1999, adds the following provisions:

- Amends the Atlantic Tunas Convention Act to allow the Secretary of Commerce to reduce swordfish quotas below International Commission for the Conservation of Atlantic Tuna (ICCAT) recommendations.
- Restricts effort increases on longliners fishing in the Mid-Atlantic bight;
  Creates a second voluntary vessel buyout category for Mid-Atlantic Bight commercial longline fishermen.

The bills are expected to be taken up again at the start of the 2000 session. The House Resources Committee has currently scheduled two hearings in February on the three house bills. With the exception of HR 3516, the bills would all support HMS management of the pelagic longline fishery through effort reductions and increased research.

9.6 HMS Management Process

The Secretary of Commerce was first given management authority for the Atlantic HMS under the Fishery Conservation Amendments of 1990. Subsequently, NMFS published a proposed process for the management of Atlantic HMS to request public comment on procedures for rulemaking and obtaining public input during the rulemaking process. A final HMS process was published in the Federal Register in 1992 that outlined the rulemaking stages of scoping, proposed rule and final rule. In 1996, the reauthorized Magnuson-Stevens Act directed the Secretary to issue FMPs for HMS not currently managed under an FMP (Atlantic Tunas) and to form Advisory Panels for each FMP. A revised HMS management process was proposed by NMFS in 1997 and specifically addressed the issue of public input through the Advisory Panels. NMFS is considering public comment on the proposed revisions to the process and will publish a final process in the future.

10. OUTLOOK

The year 1999 was eventful for HMS. The management measures from the HMS FMP and the Billfish Amendment are still in the process of being implemented and evaluated. New SCRS information, new ICCAT recommendations, and other recently released studies need to be recognized and incorporated, consistent with National Standard 2. This section reviews some of the key challenges related to current management and those that NMFS anticipates addressing in the near future. It is also a means of introducing some of the issues that will need to be addressed at the February 2000 HMS and Billfish Advisory Panel meeting. As the SAFE report is intended to provide information to help develop and evaluate regulatory adjustments, an outlook on the future of HMS fisheries is both valuable and necessary.

10.1 Outlook by Species

Swordfish

The 1999 SCRS stock assessment on North and South Atlantic swordfish was somewhat optimistic. Results indicated a higher than expected number of young swordfish in the North Atlantic stock; a sign of possible rebuilding. However, underreporting by member nations and the non-reporting of harvests from illegal, unreported, and unregulated (IUU) fishing vessels may lead to artificially low catch levels. ICCAT addressed the activities of these vessels in a 1999 resolution calling for further actions against IUU fishing activities by large scale longline vessels. The South Atlantic swordfish stock appears to be stable which provides a positive outlook for the future if harvests are controlled.

The positive outlook provided by the 1999 swordfish stock assessment spurred the adoption of a 10-year rebuilding program at ICCAT. A reduction in quotas sets the stage for long-term sustainable fisheries Atlantic-wide. The mortality of small swordfish is being addressed through proposed time/area closures in the United States, accounting for dead discards of small swordfish as part of the total allowable catch, and the ICCAT resolution to examine possible areas of small fish concentration *outside* the U.S. EEZ. There is also the possibility of other bycatch reduction measures such as gear restrictions. In 1999, the ICCAT Advisory Committee examined the issue of the effectiveness of the minimum size for swordfish. Reductions in the mortality of small swordfish may yield significant long-term gains in yield (SCRS, 1988).

In terms of addressing IUU vessels and other vessels (belonging to both non-Contracting and Contracting Parties), ICCAT took important steps in 1999 to encourage all countries to report harvests of ICCAT-regulated species. The United States will propose to implement the 1999 ICCAT recommendation that prohibits imports of swordfish and tunas from non-compliant countries. Collection of swordfish import data by the United States will prove to be an important

tool in the future to identify countries that are fishing in such a manner that diminishes the effectiveness of ICCAT conservation and management measures.

Beginning in 1998, the conservation of swordfish became an issue of heightened public consideration through campaigns such as "Give Swordfish a Break", which promote the boycotting of swordfish until a rebuilding program is in place. Fish Unlimited has recently launched a campaign to "Save Our Swordfish" (S.O.S.), as has the Coastal Conservation Association of North Carolina (Project S.E.A.). The effects of these programs aimed at reducing consumer demand have yet to be determined. However, the relative success of the campaigns may dampen domestic swordfish markets.

It appears as though swordfish are becoming more available to rod and reel fishermen on the east coast of the United States and that this recreational fishery may experience additional popularity in the future. The 1999 requirement of swordfish handgear permits and the growth of the swordfish stock (both in number of fish and size of fish) may result in commercial handgear fishermen landing a larger proportion of the annual North Atlantic swordfish quota. In the future, NMFS may need to revise the way that the annual swordfish quota is distributed between the directed fishery (commercial handgear and longline fishermen with directed permits) and the incidental fishery (recreational landings and commercial landings by fishermen who hold incidental permits).

Tunas

This year marked the first year of the 20-year rebuilding program for west Atlantic bluefin tuna. Although the status of the stock was not assessed by the SCRS in 1999, a new assessment is scheduled for the fall of 2000. Important issues that remain on the forefront of bluefin tuna conservation and management include bycatch, recreational landings monitoring, spotter aircraft use, and international compliance with ICCAT recommendations. Limited access in the bluefin tuna fishery, as well as the other Atlantic tunas fisheries, is also a mechanism being considered to address overcapitalized, and in some cases, overfished, fisheries. The ongoing archival and pop-up tagging research programs are expected to continue collecting and analyzing information about bluefin tuna stock structure and may prompt additional management concerns. Other important research with potential management implications include an assessment of the stock structure of bluefin tuna through otolith analysis and age-at-maturity studies.

Management and conservation issues of concern for other Atlantic tunas involve the overfished status of Atlantic bigeye tuna and north Atlantic albacore. Although ICCAT did adopt a resolution sponsored by the United States requesting the SCRS to develop recovery scenarios for northern albacore and extended the time/area closure in the Gulf of Guinea to help reduce catches of juvenile bigeye and yellowfin tuna, no significant actions were taken by ICCAT in 1999 to address the overfished status of these species. As part of the HMS management process, NMFS is considering the development of a rebuilding plan for North Atlantic albacore tuna. In

addition, a series of public workshops on the rebuilding of bigeye tuna is being considered in order to build momentum for conservation measures that may be introduced at the next ICCAT meeting. These issues, as well as those mentioned for bluefin tuna, may all be topics for discussion at the February 2000 HMS Advisory Panel meeting. Assessments for Atlantic yellowfin tuna and North and South Atlantic albacore tuna are planned for summer and fall of 2000, respectively.

Billfish

The management measures in the Billfish Amendment were designed to meet the 1997 ICCAT recommendation to reduce Atlantic blue and white marlin landings by at least 25 percent, as well as work towards reducing levels of overfishing and rebuilding overfished Atlantic billfish resources. Actions involved size limits, bycatch reduction measures, possession and retention limits, additional monitoring, permitting and reporting, and extension of the management unit and management authority. Some of these measures have yet to be implemented and it is too early to determine the impact of others. However, progress has been made in several areas.

Tournament registration and reporting requirements were implemented on July 1, 1999. During 1999, approximately 150 tournaments involving billfish were registered with NMFS, a substantial increase from the 98 tournaments registered in 1998. Mandatory registration should result in more effective tournament monitoring and additional catch data. As in 1998, the SEFSC selected 100 percent of these tournaments for reporting in 1999. Compilation of 1999 data is currently underway.

Outreach programs on the methods and benefits of releasing Atlantic billfish alive have yet to be implemented. Members of HMS staff recently attended a Catch and Release Symposium where valuable material on proper handling, tagging, measuring, and release techniques, as well as the effectiveness of various gear configurations (e.g., circle hooks), was presented. The information obtained at this symposium could be incorporated in future programs and management alternatives. NMFS is currently exploring external funding sources and partnerships with state and private organizations in order to extend public outreach efforts and further enhance post-release survival rates of Atlantic billfish.

The SCRS is scheduled to meet during July 2000 in Miami, FL for the next stock assessment of Atlantic blue marlin and white marlin. The next assessment of west Atlantic sailfish is scheduled for 2001. There was some concern expressed at the 1998 SCRS meeting over the incomplete reporting of Atlantic marlin and sailfish landings. At the 2000 ICCAT meeting in Morocco, U.S. delegates will have their first attempt since publication of the Billfish Amendment to work towards achieving a ten-year rebuilding program for these species. NMFS will work with ICCAT members to develop rebuilding programs that meet the standards of the Magnuson-Stevens Act, including an appropriate rebuilding time period, targets for recovery, fishing

mortality rate limits, and explicit interim milestones for recovery expressed in terms of measurable improvement of the stock.

Sharks

The HMS FMP incorporated the most recent information on catches, catch rates, biological parameters, and stock size for Atlantic sharks, and included a rebuilding plan for the overfished large coastal sharks as well as precautionary management measures for small coastal and pelagic sharks. However, the outlook for Atlantic large coastal sharks at this time is uncertain. The 1998 SEW indicated that large coastal sharks continue to be overfished in terms of excessive fishing mortality rates and depleted stock biomass. Projections in the 1998 SEW indicate that continued fishing at pre-HMS FMP levels will result in LCS stock declines at approximately 13 percent annually. The HMS FMP contained numerous measures to stop overfishing of LCS and begin rebuilding. The current court injunction, which enjoins the implementation of several commercial fishing regulations, has allowed commercial fishing to continue at pre-HMS FMP levels, whereas recreational fishing management measures in the HMS FMP were implemented in July. In addition to the current inequity between commercial and recreational shark regulations, the mortality of LCS in commercial fisheries is in excess of that prescribed in HMS FMP rebuilding plan and will have to be accounted for in future stock assessments. The effects of this additional mortality on LCS is unknown at this time.

While current fishing mortality and stock abundance estimates for SCS indicate that these species are fully fished, a stock assessment has not been conducted since 1993 and recent trends in landings and fishing practices need to be analyzed. The management measures implemented in the HMS FMP should, consistent the precautionary approach, prevent further expansion of fishing mortality on these species until a stock assessment can be conducted. A small coastal shark survey may be conducted outside of NMFS subject to grant approval. Similarly, management measures for pelagic sharks were implemented to ensure that all sources of fishing mortality are accounted for and to limit expansion of fishing pressure until additional analyses can be conducted.

International efforts to conserve and manage sharks continue to gain momentum. The ICCAT Sub-committee on bycatch held a workshop to analyze pelagic shark catch rates. NMFS is continuing to develop a National Plan of Action for shark conservation and management, consistent with FAO guidelines and requirements. Additionally, two international workshops on pelagic sharks are scheduled for February, 2000. These efforts should contribute to the general awareness of the need for long-term, rational domestic and international management of all sharks.

10.2 Data and Monitoring Issues

Improving data coordination is essential for successful HMS management. As fisheries resources become increasingly managed under quota systems, real time monitoring is critical. Failure to abide by the quota levels established by international agreement may result in penalties assessed against future U.S. harvests. In order for the United States to continue to serve as a leader in the conservation of these resources, the development and use of innovative techniques must receive proper attention and funding. The following is a short list of data management tools and techniques that may assist in HMS management:

- The development of streamlined systems that transcend the traditional regional structures of NMFS data collection, entry, and dissemination.

- Improvement in the coordination of data collection and organization among various components of the agency.

- Use of systems like AppNet to consolidate data and add to the rapid dispersal of information.

- Placement of summary data on the HMS web page.

- Placing data in consolidated Oracle tables.

- Improved tracking of dealer reports.

- Development of an external e-mail system in addition to the fax notice system.

- Resolution of the LPS status including a retrospective analysis of the existing system and the exploration of alternative methods to gather increasingly accurate data from the recreational components in the future.

- The use of electronic logbooks to facilitate reporting and data analysis.

NMFS is also developing a simple, user-friendly identification guide to commonly fished Atlantic highly migratory species. The manual is intended for use by fishermen, enforcement officers, and fishery samplers. Particularly for the wide variety of Atlantic sharks, identification down to the species level is difficult for many recreational and commercial fishermen. Disseminating these guides is expected to increase the quality of species-specific landing data, and compliment the observer, logbook, and dockside monitoring systems already in place.

10.3 Research Needs

The Comprehensive Research and Monitoring Plan for Atlantic Highly Migratory Species (Appendix I) details current research underway as well as those studies that may directly benefit future HMS management.

10.4 Conclusion

The SAFE report is designed to not only summarize the current condition of the resource, but also address whether or not the fishery is operating properly under the mandates of the Magnuson-Stevens Fishery Conservation and Management Act and the Sustainable Fisheries Act. Through an annual appraisal of recent information, the SAFE report allows for a re-evaluation of management measures in light of the Magnuson-Stevens provisions and the National Standard Guidelines. In 2000, HMS plans to continue implementing and evaluating the FMP measures in an attempt to remedy the overcapitalization and overfishing problems that affect many highly migratory species. The February 2000 AP meeting provides an excellent opportunity to identify and discuss those issues raised in the SAFE report which require further management. Through continuous public and constituent interaction, increased monitoring, ongoing life history work, and additional socio-economic assessment, HMS strives to continue building sustainable fisheries for all Atlantic highly migratory species.